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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

Motorship

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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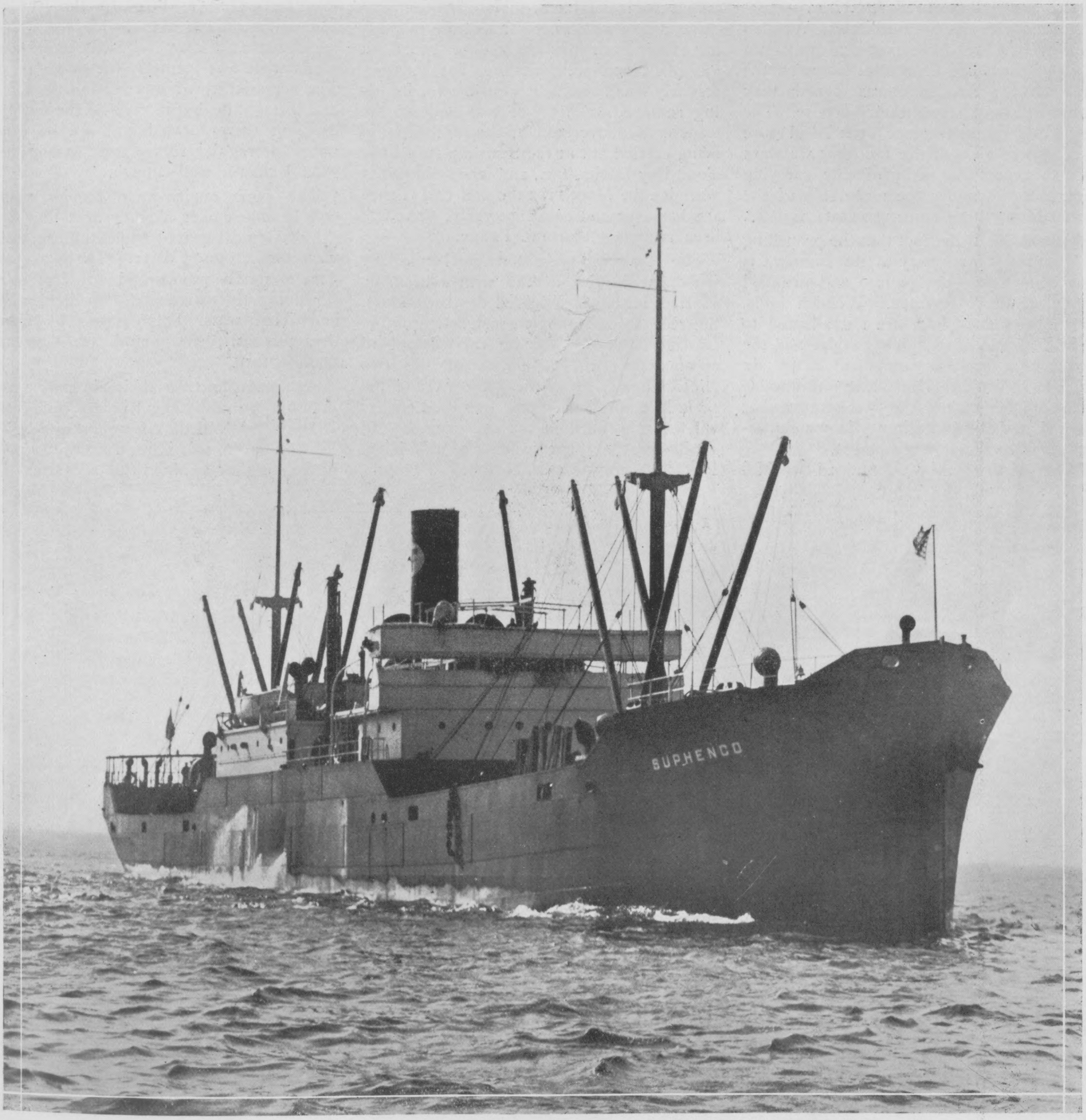


SENATE ACTION ON STEAMER CONVERSION BILL EXPECTED DAILY

The longer we delay placing a fleet of motorships in service, the more we are handicapping ourselves with respect to foreign competition, as Diesel vessels are being built abroad at an increasingly rapid rate. Oil within our portals should be an aid to economical operation of our motorships in competition with those of other nations when the World's merchant marine is mainly Diesel-driven. Some of our leading shipowners have not waited for Federal action, but have proceeded with limited new motorship construction or conversion of existing steam craft. The vessel illustrated above, owned by the Submarine Boat Corp. was commenced as a steamer but finished as a motorship.

Auxiliary Converted to Full Motor Power

Propelling and Auxiliary Machinery Is Taken Over Bodily From War-time Wooden Motorship and Used to Remake a Steel Vessel Formerly Underpowered; Steam Auxiliaries Replaced by Wooden Ship's Electrical Equipment

MOTOR equipment makes good no matter where it may be installed or what the varying fortunes of the vessels to which it is applied may be. Another instance of this is the reconditioning of the motorship MOONLITE, which will be re-equipped with the propelling machinery installed in the wooden motorship BENOWA in 1918.

It will be recalled that the BENOWA was reported in MOTORSHIP for August, 1919, as the first full-powered American motorship fitted with electric auxiliaries. Wooden ships were a war-time expedient and even if all of them had been total losses on the day that the Armistice was signed, they would still have served their purpose. The vessel in question has done a good deal more than that in view of the fact that we were able to report her as profitably carrying paper cargoes under the ownership of the Ocean Motorship Company as late as 1922.

Remarkable is the fact that the propelling and auxiliary machinery of the BENOWA is now being taken out *in toto* and installed bodily in the MOONLITE. Wooden hulls, which bend and yield, are not adapted to make any kind of machinery thrive and the reutilization of this equipment after six years of difficult service under unfavorable circumstances makes it appear strange that there should still be hesitancy in some quarters about *new* motor equipment.

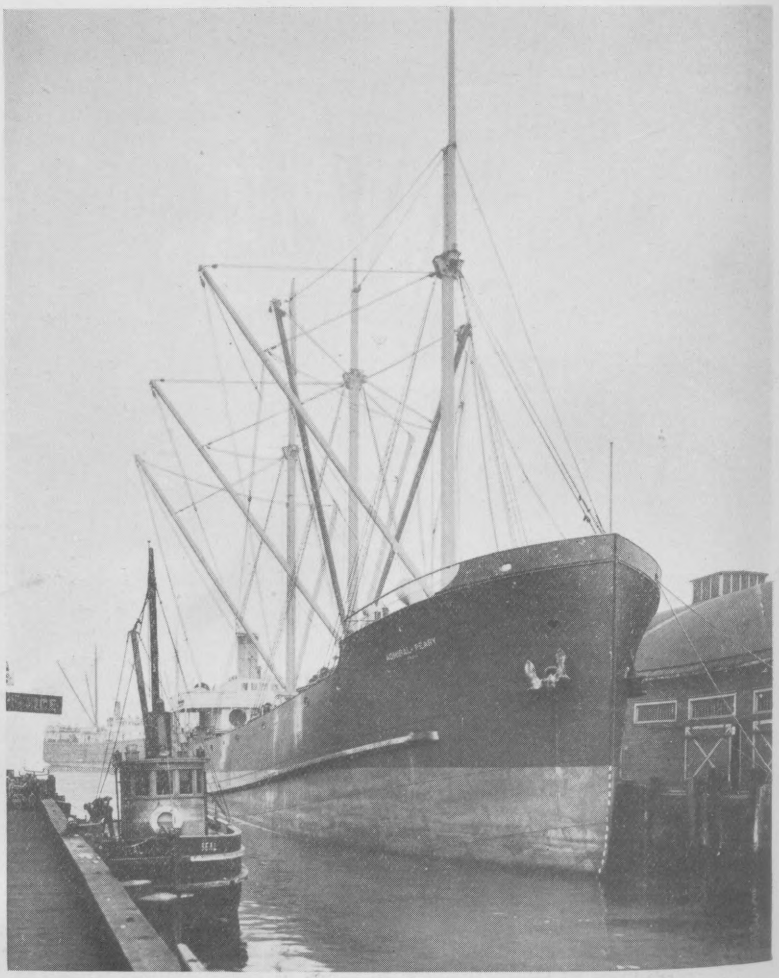
Whereas the BENOWA contained two McIntosh & Seymour 500-b.h.p. engines, the MOONLITE formerly was equipped with only a single 320-b.h.p. surface ignition machine, a fact which necessitated the rebuilding of her stern for twin screws. Since the old plant ran well, nothing but its grotesquely small size is responsible for its being replaced. This work, as well as the transfer and overhaul of the machinery is being carried out at the Seattle plant of the Todd Dry Docks, Inc., and when completed will give the MOONLITE the first real chance she has ever had as a motorship. She has been renamed ADMIRAL PEARY.

She is a 1930-gross tons steel auxiliary schooner 252 feet overall with a beam of 43 ft. 7 in. and a moulded depth of 21 ft. Suitable plate-and-angle construction on the existing tank-top will be carried out to accommodate the bedplates of the two Diesel engines from the BENOWA and the same Maxim silencer that was used on her will be reinstalled in the steel vessel. An auxiliary generator consisting of a 75-b.h.p. Fairbanks-Morse surface ignition engine, direct-connected to a 60-kw. G. E. dynamo, will be moved and will be supplemented by a new duplicate set of the same size and make to take care of the additional auxiliary load of the twin-screw installation. These two generating units will be roomily located on the port and starboard machinery flats.

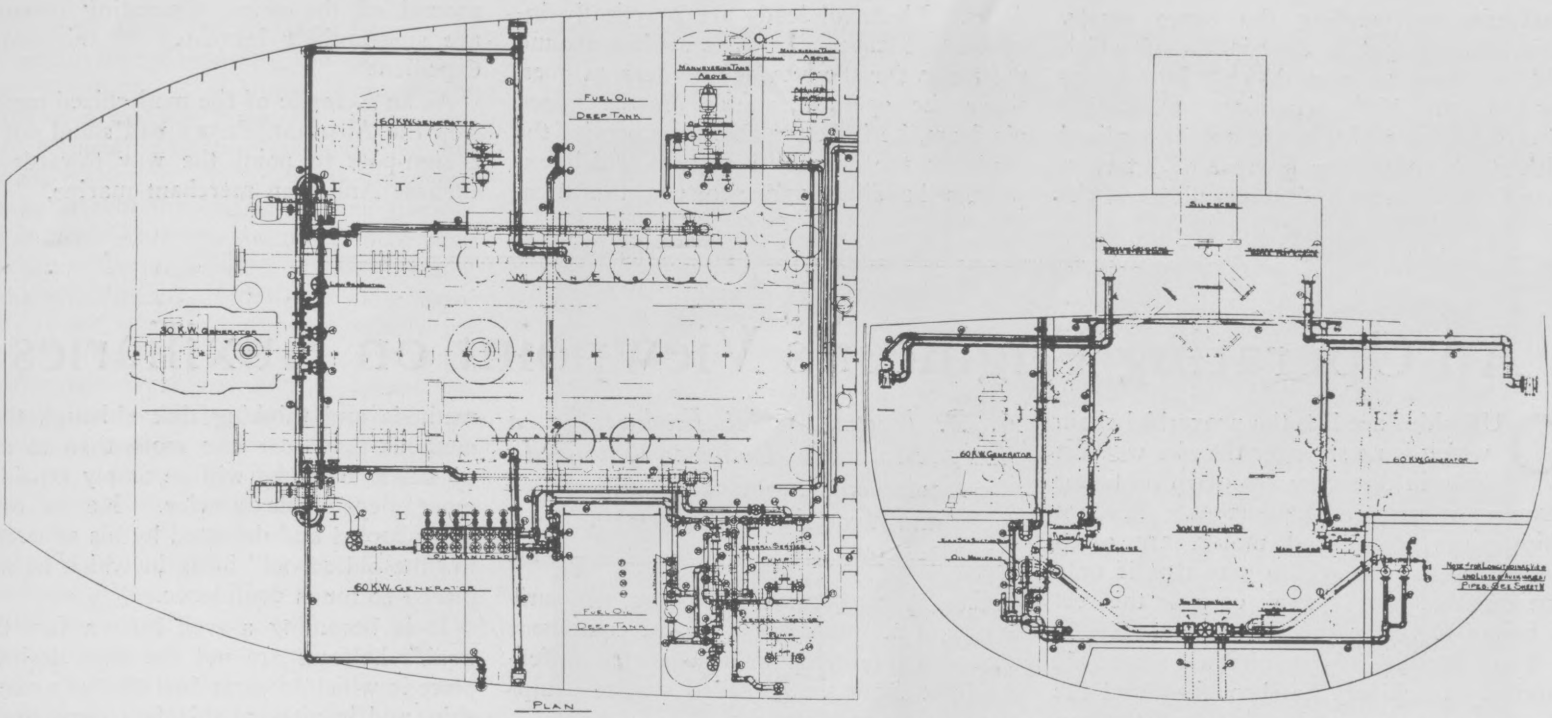
To take care of the lighting and to act as an emergency standby a 37½-b.h.p. auxiliary oil-engined generator by the same manufacturers was fitted on the BENOWA and will be taken over bodily for use on the ADMIRAL PEARY. It will be installed aft in what was formerly the thrust recess. The accessibility of this location is not all that it might be, but in view of the fact that the unit there located will not be called upon for regular service, the arrangement should answer well enough.

The same engine-room service pumps will be taken over as they are: they consist of Goulds' geared triplex-plunger units with direct motor drive. There are two general service pumps and a fuel oil transfer pump thus arranged. Sanitary water and fresh water are pumped by direct-driven centrifugal pumps of the same manufacture.

As a supplement to the main engine compressors a multi-stage Rix air compressor is being reinstalled. It compresses to 350 lbs. per sq. in. and is used mainly to pump up starting air at about this pressure. The



"Admiral Peary," formerly the single-screw auxiliary motor schooner "Moonlite," has been converted to twin-screw full Diesel power with engines taken out of the wooden ship "Benowa"



Engine-room arrangement of "Admiral Peary," showing utilization of forward bulkhead and deep tank. The conversion of this former auxiliary schooner to full Diesel power did not materially reduce the capacity of the vessel

BENOWA's booster compressor, also of the same make, is capable of raising the starting air to the injection pressure of 900 lbs. per sq. in. Owing to the use of crossheads on these little machines for the high pressure cylinders, they maintain their ability to deliver over a long period of time. Using an independent booster for the exclusive purpose of making injection air commends itself in several ways. Since the loss of spray air is a comparatively rare occurrence and as the use of a starting air compressor is considerably more frequent, it is a disadvantage to the latter to load it down with a high stage that limits its output and increases its power consumption while starting air is being pumped.

Injection and starting air tanks will of course be transferred, a fact which throws an interesting sidelight on the question of oil engine depreciation charges. A substantial part of the first cost of an oil engine power plant is made up of elements having a somewhat high first cost, but subject to no depreciation capable of being calculated. The tanks in question will be as good years hence as they ever were and the same applies to other parts of the oil engine plant such as bedplate and framing.

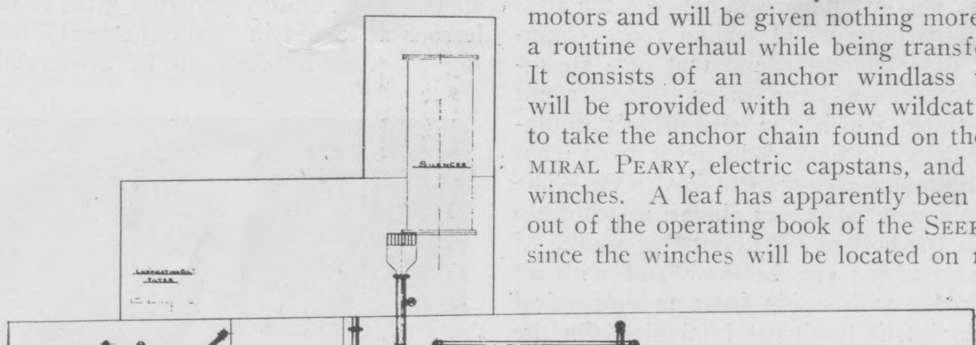
An unusual feature of the conversion work is the partial utilization of the existing engine-room bulkhead and deep tank next to it. Because of the greater power and overall length of the engines taken from the BENOWA the new bulkhead will be located ten frames further forward and the deep tank dispensed with. Two of the wooden ship's fuel tanks will be located on the ADMIRAL PEARY's deck under No. 2 winch platform and additional fuel will be carried in the double bottom. The old deep tank will be cut through in the middle to provide space for the main engines and what is left of it on each side will be used for settling tanks.

One of the reasons why the BENOWA survived as long as she did was because she was not encumbered with steam auxiliaries, a lesson which is being heeded in the scrapping of the ADMIRAL PEARY's steam plant. Exhausts from the main engines, fitted with expansion joints, are being led to a "Y" near the forward bulkhead and thence up to the Maxim silencer, in which will be placed 50 sq. ft. of heating coils. Connected to the latter will be the heating system throughout the ship, hot water storage tanks, hot water circulating pump, fuel oil tanks, and oil storage tanks. As the former boiler casing extended up above the poop deck, it is now being cut flush with the latter and will be decked over and finished to match existing work.

All quarters will have both hot and cold running water and will be heated by means of radiators.

The old electric steering gear will also be reused in place of the hand gear, which is to be removed. As it consists of a motor-driven differential screw controlled by port and starboard switches and hard-over cut-outs, it belongs to the simplest type of electric steering apparatus known. A tell-tale in the pilot house indicates to the navigator how much helm he is at any time giving to the vessel. Its long and satisfactory service on the BENOWA gives yet another confirmation of the principle of making things simple.

All deck machinery, as has already been stated, will be driven by G. E. watertight motors and will be given nothing more than a routine overhaul while being transferred. It consists of an anchor windlass which will be provided with a new wildcat head to take the anchor chain found on the ADMIRAL PEARY, electric capstans, and cargo winches. A leaf has apparently been taken out of the operating book of the SEEKONK, since the winches will be located on raised



Surface-ignition auxiliary engines furnishing electric power were re-installed after long service on wooden ship

platforms surrounding the cargo masts. This arrangement, a description of which will be found on page 183 of MOTORSHIP for March, 1924, combines a number of advantages which could not be realized with steam machinery because of interference from exhaust and steam pipes on the decks. Electrical leads are practically invisible and leave a clear run of deck around the masts for the stowage of deck cargoes. Since the operator stands on the raised platform, he is better able to supervise the loads on the cranes, a feature which expedites handling and shortens the turn-around of the ship. Operating revenues are substantially increased by this simple expedient.

As an example of the modernized motorship the ADMIRAL PEARY will stand out as a sign-post to point the way towards an efficient American merchant marine.

An Operating Engineer's Viewpoint on Auxiliaries

A. B. Newell, Chief Engineer of a Large Motorship, Endorses Motorized Equipment, Centrifugal Purifiers and Accessible Arrangement

OUR ships are like the proverbial chain which is no stronger than its weakest link, in that they are often no better than their poorest equipment. Modern ships, both steam and motor, are often linked together in such a way that if only one essential part is weak or poor the rest is bound to suffer.

The demand for suitable motorship auxiliary machinery has brought about the development of new types in which the tendency is to make extensive departures from former standard practices, with a view to effecting greater economy.

A human fallacy is to jump to unfavorable conclusions about things which are not thoroughly understood. Thus we may condemn some new type of equipment before giving careful study to its requirements in the way of installation, care, operation and the work which it is to do.

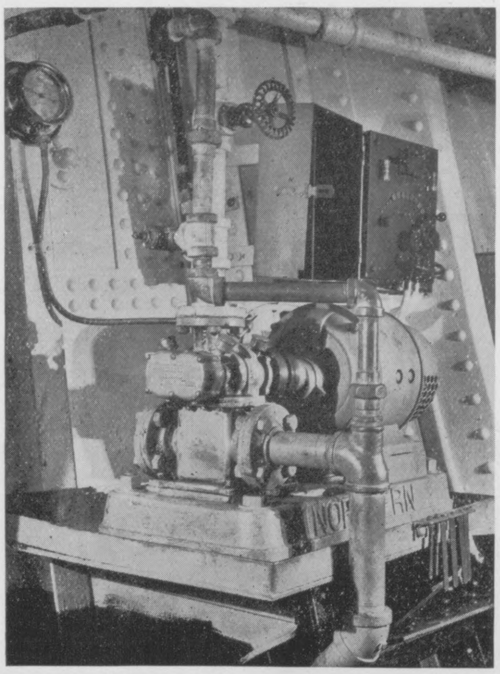
The greatest lesson which ship owners have learned in the last decade is that motorships are more economical than steamships and in every way more suited to their need of a cheaper method of transportation. The next greatest lesson, which they are learning, is that the auxiliary machinery and equipment which has proven entirely satisfactory in steam vessels is not well adapted to the requirements of motor vessels.

There is no comparison between the auxiliary machinery and engine room equipment of a motorship and that of a steamship after we have taken into account everything which the steamship's equipment does and have deducted it from what the motorship's equipment has to do. The whole source of power aboard a steamship lies in the boilers. Without that source of power nothing can be done and with all credit due to it, aside from an economical standpoint, it is almost infallible. On the motorship we have a main propelling unit entirely dependent upon auxiliary units not for its power but contributory factors which make that power possible. These auxiliary units then must be as infallible as the main unit itself. On a steamship combustion is brought about in a boiler furnace where fineness of control is the only essential for economy. In a motor, combustion is brought about within a cylinder where an irregularity will have a direct effect upon mechanical conditions.

Not having the great incinerator in which all fuels are reduced to common steam to be used for every purpose and which will serve all purposes, both great and small, it behooves us to regard our fuel tanks, auxiliary engines, pumps, air compressors, oil purifiers and all other engine-room equipment aboard a motorship in a somewhat different light from the so-called similar equipment on a steam vessel.

There is no need to touch upon the quality of auxiliary machinery such as oil engines and electric generators, motors and pumps, heating devices and oil purifiers. This has been well established and it only remains to show how important it is to have these well-installed and properly cared for. It is equally needless to include in this writing anything in the form of operating instruction, for this subject is always completely covered by the builder in his instruction pamphlets and would total enough to fill a large volume.

The viewpoint of the naval architect is often a good barometer by which to judge the ensuing storms of battle between the designer and the prospective motorship owner. The former judges the needs of a new ship by making comparisons with similar ships in operation which have weak spots. The ship owner often leans toward lessons as taught in "the old school," holding to what he feels to be conservative methods and thinking that although these methods may cost him more than to take up newer ones, he will be amply repaid in more dependable service. He is often badly fooled and defeated by his adherence to "the old school" ideas in which he misplaced so much confidence.



An accessible auxiliary quickly pays for itself in better up-keep and in preventing main engine routine from being interfered with

It is becoming a well known fact that double bottoms are not the most desirable place in which to carry fuel oils for a motorship, and in view of this fact some prominent architects are advocating the construction of tanks with an air space between them and the sea, thus making it impossible to bring about a mixture of sea water and fuel oil, either through failure to completely dry up the water ballast which may have been in the tanks before, or through leakage. This is the plain lesson of some very unfortunate experiences with sea water in suspension, which has badly damaged a number of motors.

This expedient being impossible with ships which are already built, and for that matter the construction of such tanks in a new ship costs more than results gained would justify even though results are positive, for at the present time mechanical purifiers are successfully doing what settling tanks and the application of heat in an attempt to precipitate water in suspension failed to do.

Although it may not be generally known, the installation of such a purifier to be used in connection with the fuel oil system will in time prove to be one of the most paying investments which it is possible to make. Several important rules should be born in mind when the installation of such a purifier is made. It should have twice the capacity of the engine's fuel consumption in order to give ample time for the accumulation of a surplus of processed fuel to be used while the machine is being cleaned, or there should be two machines either one of which would have sufficient capacity to handle the job. It should be installed in such a place that it will be always in sight so that if it is dirty or ill-kept it will be an "eye sore"; this because it may not be used for a year at a time and if stuck off in a corner, out of sight, it may be forgotten and allowed to get in bad order from lack of use and attention. It should be kept away from ventilators and skylights to prevent salt spume from striking it in bad weather, and where there is auxiliary steam power aboard, the vent from the feed and filter tank as well as any other leaking or escaping steam should be clear of it. All of these

extra precautions are advisable because of the importance of having the machine in good condition, at all times, even in the hands of a careless crew.

To reclaim lubricating oil is another important matter in which almost every one will agree that the end more than justifies the means. Although the mechanical purifier is not the only means of doing this, it is the ideal means of doing it more especially if the ship is equipped similarly for handling fuel oils. Not because a single purifier will serve for both purposes but because the reclaiming of lubricants must be done at regular intervals, and the crew will always be familiar with the operation of such a machine, and in the event of their having to put the large one in operation to handle contaminated fuel they can have it in hand at once.

How to install a purifier and how to operate one is not so important as why it should be done, and I know of no better means of convincing a skeptic than to refer him to a previous article covering salt water in suspension which was published in MOTORSHIP some months ago.

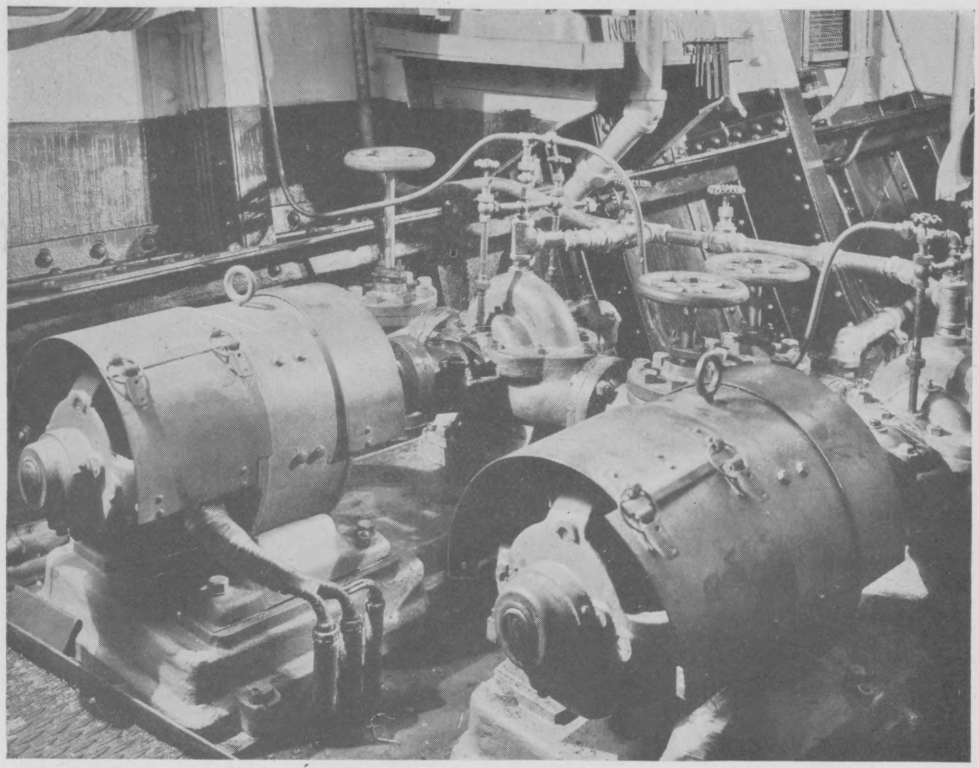
Ideal auxiliary machinery should require a minimum of attention. We must face the problem of the operation of oil engines and Diesel motors fairly and squarely. They will not run without attention, they must be kept up by doing a certain amount of routine work. This work is just as important as washing boilers and punching flues on a steamship and amounts to about the same thing as far as relative importance is concerned. It is less work, of course, but the motorship's crew is smaller in proportion. I wish to dispel any thought that a motor is of the nature of perpetual motion. Then auxiliary machinery must not rob the main propelling unit of the attention justly due it.

It is quite possible for poor auxiliaries to do just that, for the average large Diesel will take a lot of punishment and abuse and still carry on, giving fairly satisfactory service; service so satisfactory in fact, that it may be a year or two before neglect will cause it to give serious trouble. Such service is wonderful provided it is not abused, but it will be abused if the auxiliaries are such that they will require immediate and constant attention.

Here then is where the modern equipment comes in. A centrifugal pump driven with an electric motor standing out in the open where it can be easily cleaned and oiled will run indefinitely without a thing in the way of repair. Compare it with a steam pump which has to have rods packed and the liquid end opened up occasionally, valves fitted and all the pampering common to its kind to keep it running and the time robbed from the main unit will be immediately noticeable.

Take a good pump, one of the perpetual motion type and stick it off in a hole which will barely contain it, some place where a man will have to be a contortionist to reach it, and that pump will get out of order.

The time spent in putting it in order in such a place may mean that three or four



These pumps are out in the open where everybody can see them. "The stitch in time" is therefore always done on them and they do not take up crew's time which should go to the main engine

exhaust valves on the main engine will have to make another trip without grinding. If it is a circulating pump it may be neglected until it fails entirely and an overheated cylinder head may result, followed by a crack generally impossible to repair.

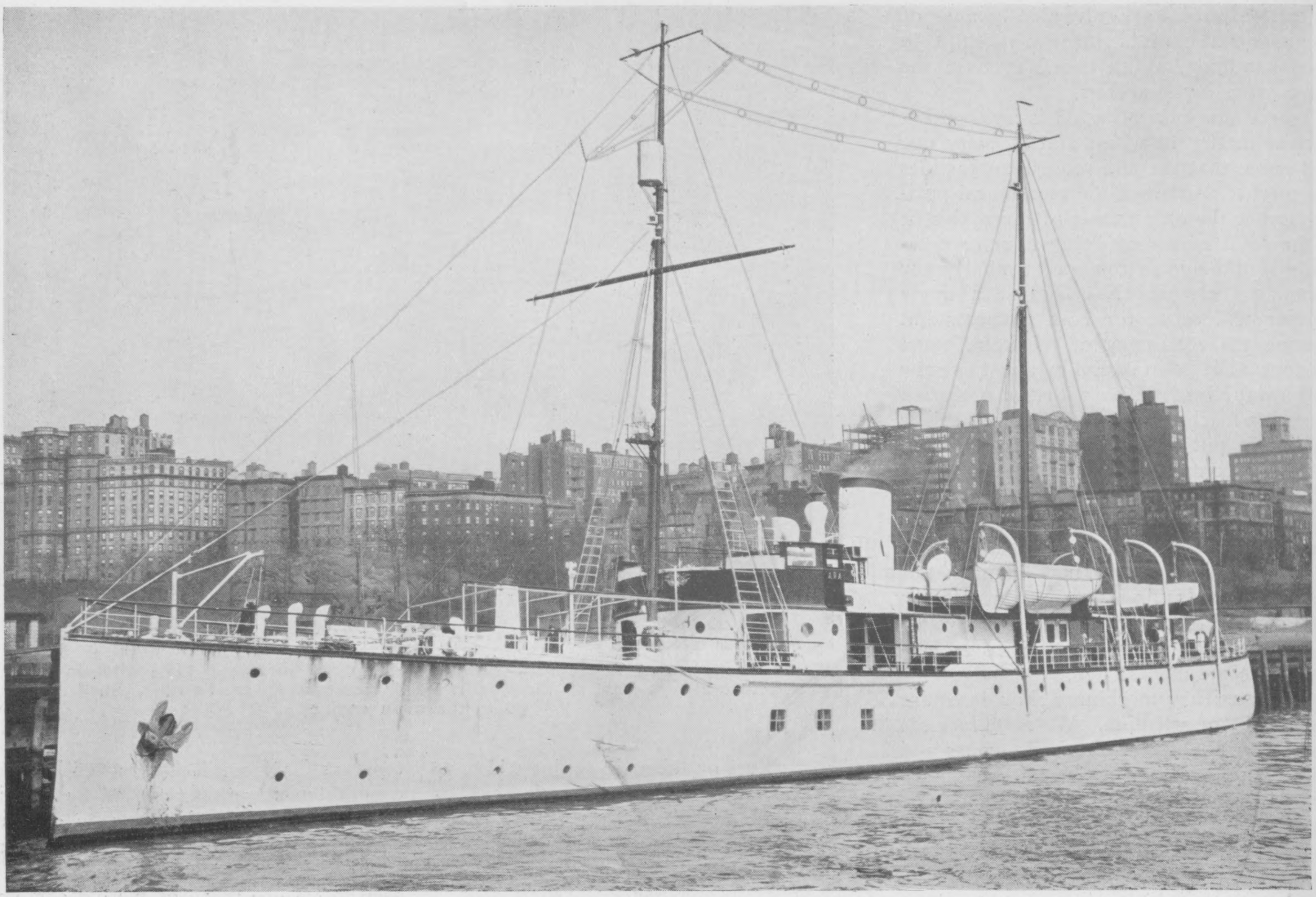
Take a pair of clean lubricating oil pumps standing in an open space easily accessible and so located that their dirty or ill-kept condition would shame even a lazy man and compare them with a set of pumps under the floor plates where they are never noticed, where a leaking gland will not be found until the loss of lubricating oil compels a search. Once they give trouble some one has to go on their repair, go bilge diving. Perhaps they have been let go until the ship arrives in port. Then it is a case of fix that pump. The man who should be spending his time keying up the top end of number four is sweating and cursing the man who put an essential pump in the bilges, of course the crosshead will run another trip and the ship must not be delayed.

Let us take a steam-driven compressor and compare it with an electric-driven one. The steam end of the compressor first mentioned is what requires attention. The electric end of the second is what requires practically no attention. The time thus saved may be applied to the main engines and I am not saying a word about the time required to take care of a condenser, a boiler and a feed and filter tank. Motor engineers, it is only fair to state, are frequently enthusiasts for the more modern kind of machinery and do not always have the same patience with the cruder steam equipment. Electric wires and conduits as well as switches and starters do not wear out, but what about steam pipes and valves!

It is unfortunate that occasionally we find a motorship in which the main propelling units suffer from lack of attention solely due to the attention required by auxiliary equipment. This is generally the case where a conversion has been made from steam to motor and the first thought has been to save as much of the old equipment as possible with a view to reducing the cost of conversion. Generally the folly of such methods is apparent even before the conversion is completed and by those who have been responsible for the methods employed. However, they do not retrench for they feel that after spending so much on the start that they will come out cheaper by going on than by condemning partially finished work and making the conversion as it should be: that is with oil engine and electrical auxiliary power.

Sometimes the thought is expressed that the average engineer is not equal to the operation of modern electric auxiliary machinery. After all, that is the operating engineer's problem, one which he must solve for his own good and one which, if he has any common sense at all, he will gladly solve in order to save himself a lot of extra work and worry. The thought that operating engineers cannot master the intricate problems of modern auxiliary machinery operation is as groundless as the old idea that he could not operate Diesels both large and small.

Give the main engines a show by not installing auxiliaries which will require all of the attention of all of the engine room force all of the time. Give these auxiliaries a show by placing them out in the open where they are easily accessible. It is false economy to rob the engine space of a motorship just because it can be done. Every one knows that the motorship carries enough extra cargo and burns enough less fuel to entitle it to some—yes, extra consideration.



Wm. K. Vanderbilt's Diesel yacht "Ara" in the Hudson off Riverside Drive. She is propelled by twin 825 b.h.p. Atlas-Polar oil engines. Originally built for a French yachtsman, she was used as a submarine patrol during the war

Ara, a Diesel-Driven Yacht, Now American-Owned

She Has Been Bought by W. K. Vanderbilt, Who Has Richly and Tastefully Refurnished Her Living Quarters; Her Twin 825 b.h.p. Diesels Were Taken Over Unaltered

MOTOR-DRIVEN yachts are replacing steam-driven craft at an ever-increasing rate. Cleanliness in operation, speed, long cruising radius, smaller engine room crew and many other advantages have rendered them so attractive for this most exacting class of service that few other types of vessels are being considered. Since they are purely a luxury article, in which cost is a secondary consideration, they form one of the most emphatic endorsements of the conveniences and good qualities afforded by oil engines. Whereas lumbering cargo carriers bring into bold relief the economic properties of the oil engines, the luxuriously fitted yacht gives striking testimony of the operating conveniences and desirable features of the modern heavy oil prime mover.

During 1913 the ARA, a particularly fine example of a millionaire's yacht was commenced at Southampton, England, but owing to the World War was taken over by the French Government and subsequently used as a submarine chaser. She did good service as a patrol boat through the years of the war and was rendered especially efficient for this work because of her independence of fuel supplies and her ability to get under way at a few minutes' notice. Although no actual instances of her having encountered any submarines are on record, there can be no doubt that her presence contributed in a large measure to securing the waters surrounding the British Isles against the submarine terror.

Starboard view of awning deck, looking aft from bridge

In 1922 she was purchased by Wm. K. Vanderbilt, who has thoroughly reconditioned the living quarters of the yacht, but who found it unnecessary to do anything but routine overhauls of the propelling and auxiliary machinery. During our recent visit to this fine vessel, which we did at Mr. Vanderbilt's courteous invitation, we found that a cylinder head of one of the Diesel engines had been removed for inspection. We were permitted to look at the head and cylinder walls and found them as glassy and free from imperfections of any kind as though they had been only recently put in commission. Nevertheless, the vessel had just completed a non-stop voyage of seven thousand miles in the course of which the machinery was run continuously at full power.

The ARA is 213½ ft. long overall, has a depth to the awning deck of 22 ft. 4 in. and a beam of 31 ft. 3 in. It is apparent from the appended illustrations of her plans that she is of the awning deck type and makes a dashing appearance because of her ram bow and cruiser stern.

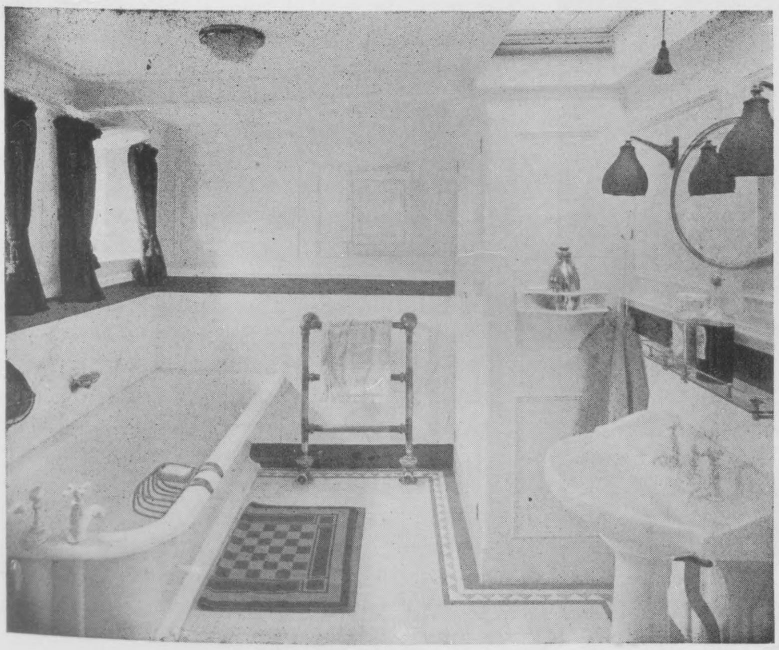
Living room

Gangway doors giving direct access to the upper deck are of special construction, and they have proved to be entirely watertight. Since the upper deck of the drawing room was lowered 2 ft. in order to give 10 ft. of head room, a certain amount of space below decks had to be sacrificed; but as this came over some little-used passageways connecting the galley with the crew's quarters, no sacrifice of convenience resulted from the change.

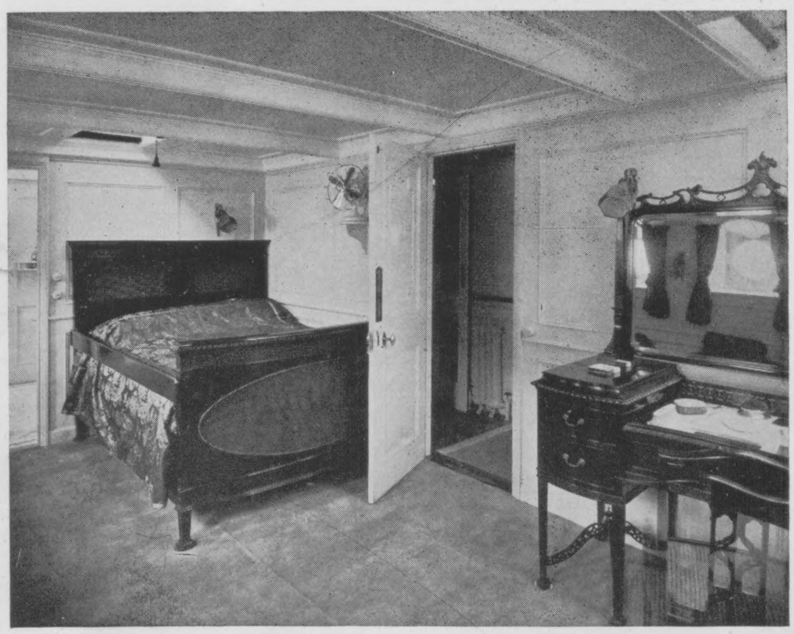
From the starboard gangway on the upper deck, the main vestibule extends aft for the entire length engine casing, and as it is panelled throughout with white enamel it makes an attractive impression. A lavatory at the forward end is richly but simply furnished and suggests the arrangements commonly found in our most high-grade and modern apartment houses.

Double mosquito doors separate a center line corridor from the main vestibule, and the former leads to the doors of the owner's and five guests' staterooms, all except one of which have private bathrooms fitted in the same way as the one at the head of the starboard gangway. Arm chairs, electric fans, dressing table and wardrobe are provided in all these cabins and have been chosen with rich quiet taste that makes a most homelike and at the same time elegant impression.

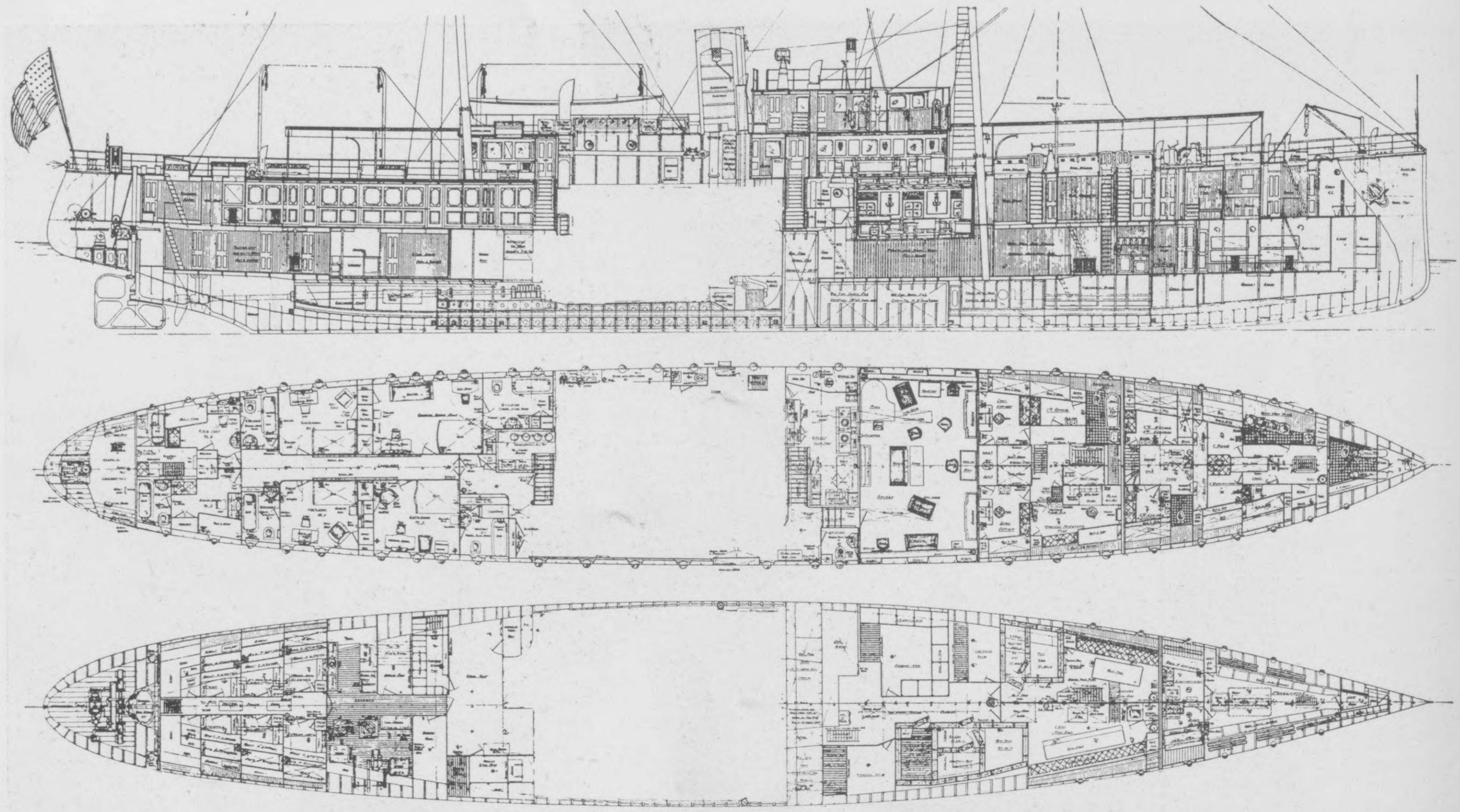
Different panellings and finishes are used



Owner's bathroom



Owner's stateroom



Plans of former submarine patrol yacht "Ara." As our plans showed engines which were originally intended for this vessel but never actually installed, we are leaving the space for them blank. The type of machine which is installed has separate scavenging pumps which are run as air motors while the engine is being maneuvered

in all the cabins, but they are all alike in showing richness combined with good taste.

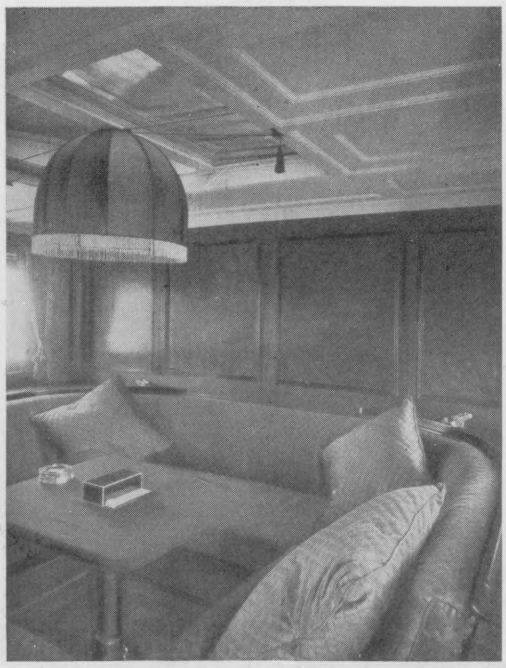
The lobby is situated two stairs up from the entrance vestibule on the upper deck, and from there the dining room in the deck house may be reached. Blue and oxidized silver give the dining room a subdued and remarkably attractive coziness suggestive of the quiet cottage at a secluded lakeside rather than the dining room of a modern financial leader.

A remarkable impression is made by the owner's living room, which takes up the entire width of the ship, and suggests a spacious dwelling on Fifth Avenue rather than a compartment on a ship. It has a fireplace, reading lamps, book shelves and curio cases, plainly showing the interest which the owner has for artistic and intellectual matters. This room and indeed all the living quarters of the boat are inter-connected by telephones.

Mr. Vanderbilt is a practiced navigator and holds his own license as captain. Whenever he is on board he is in command of the ship and navigates her with skill and care. All the most modern equipment is fitted in the pilot house, the most notable feature of which being a Sperry Gyro Compass.

Magnetic compasses are subject to deviations that vary not only from place to place, but from season to season. Although the Hydrographic Office publishes corrections at stated intervals, they do not suffice to eliminate substantial errors and consequently appreciable unnecessary lengthenings of the courses which are being steered. The gyro compass improves the precision of navigation to such an extent that worth-while savings in time and fuel are effected by its use.

Our impression of the engine room was a most favorable one, as all the machinery which we saw was worn and shiny in places, showing that it had not been taken down for a number of years. It is easy to tell from the looks of an installation if there has been a good deal of tinkering with it, but the unmistakable signs of these Polar Atlas Diesel engines showed that they had been handled for propelling the ship and had hardly been touched for any other purpose. There are two main engines of 825 b.h.p. each, running at 165 r.p.m., bore and stroke dimensions are 17¾ in. by 21¼ in., and there are six cylinders, two scavenging pumps and four air compressors to each unit. Cross-heads are fitted, but unlike most of the Polar engines, the underside of the pistons is not used to provide scavenging air but acts directly on the cross-heads. Owing to the use of a simple two-cycle system, the engine cylinders are entirely valveless except for the fuel valve, not even the starting valve being fitted. For maneuvering, the scavenging pumps are temporarily converted into air-starting motors and are built with sufficient strength to handle the high pressure starting air. As soon as the engines have picked up on fuel, a simple movement of one of the controls makes the scavenging pumps function normally. Three of the injection and starting air compressors, which are located in the rear of the engines and driven off the beam, are used in continuous service while the fourth one is disconnected and the spare parts for which are secured to the hull. Owing to the large air compressing capacity thus furnished, the compressors are worked at very moderate loads, and they accordingly stood us so well that they look as though no wrench or hammer has been applied to them for an indefinite period.



Card room

In talking with the chief, Mr. Martin, our impression that the engine had been practically free from operating interruptions was fully confirmed.

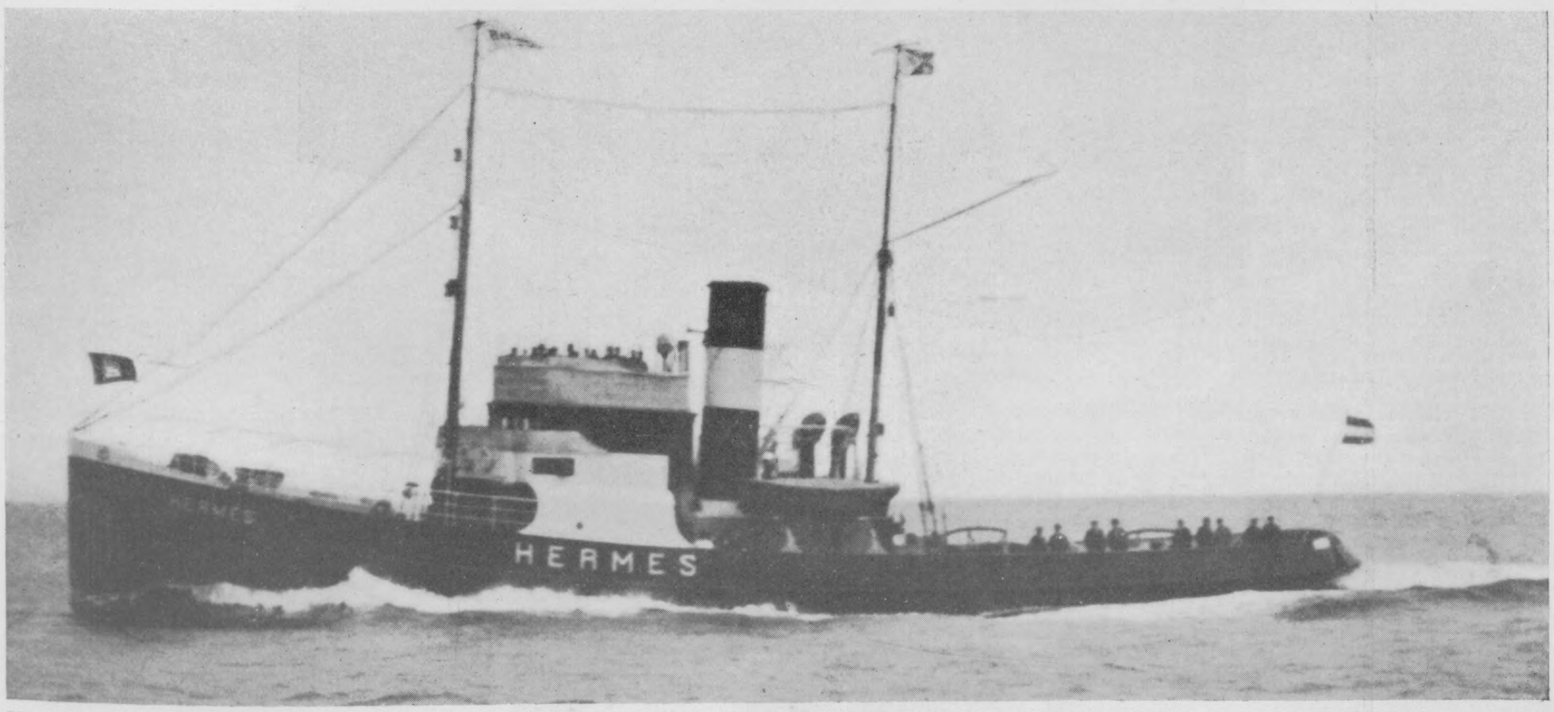
Cross-heads of ample surface make possible the use of short connecting rods having a ratio of about 3½ to 1, and a material saving in engine height is thereby effected. Since iron framing carrying the cross-head guides is fitted only in the rear of the engine, and the inboard or operating side is supported only by forged steel columns, it is left entirely open for

Dining saloon

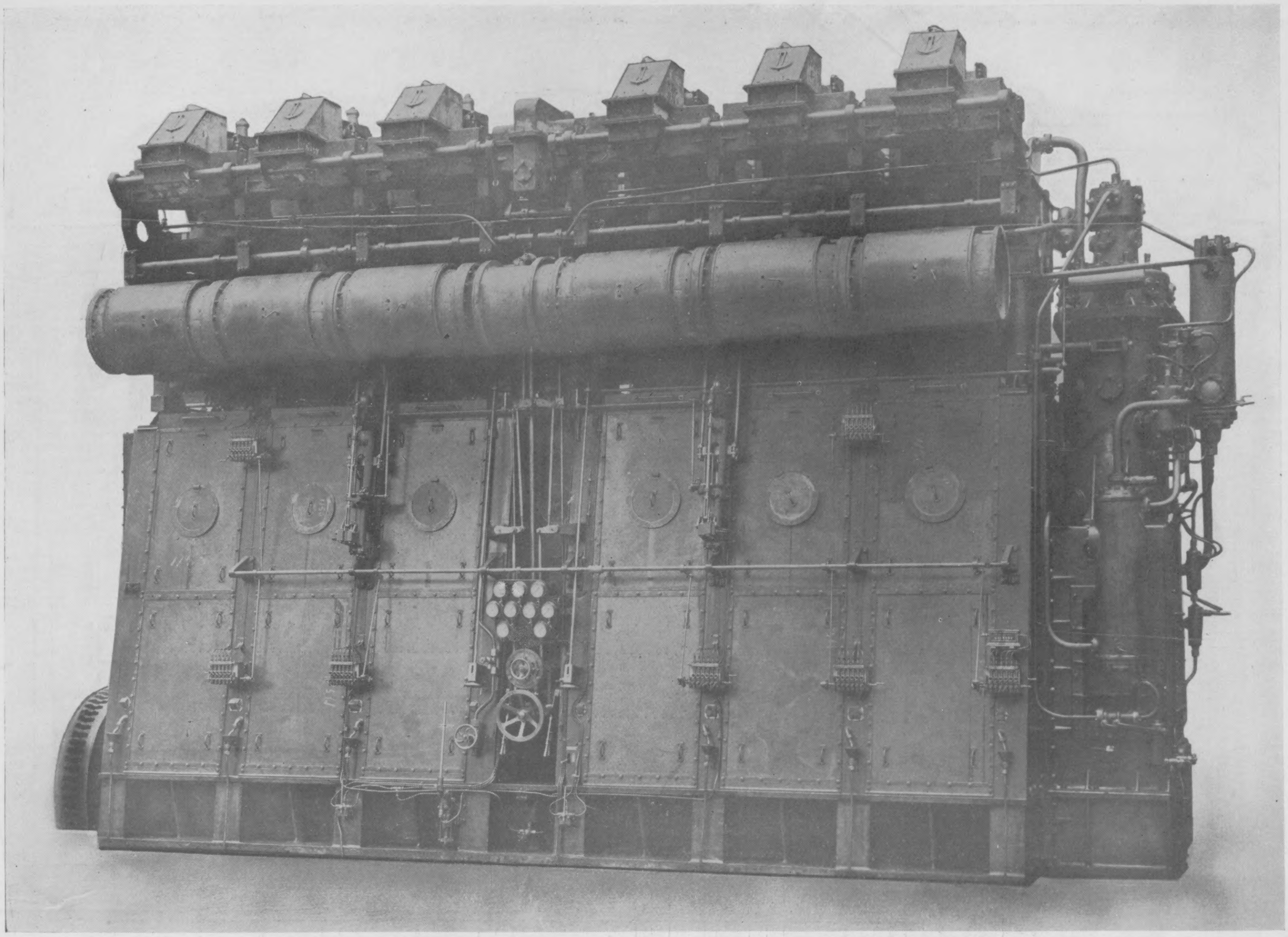
inspection and keying up. Gravity lubrication is used for all the moving parts and although this system has of late been superseded to a certain extent by force feed oiling, its success on this particular motorship job cannot be doubted.

Auxiliary power is furnished by Gardner surface ignition engines of 20 b.h.p. each driving 12 KW. direct current generators. These engines struck us as being particularly well finished and of a grade which is not commonly furnished in a type of engine one of whose biggest talking points is low first cost.

Mr. Vanderbilt is enthusiastic about his beautifully-equipped motor-vessel and considers it a big improvement over his former steam yacht.



Highest-powered ocean-going Diesel tug has twin 500 b.h.p. A. E. G.—Burmeister & Wain engines which give her a speed of 13¾ knots light. Her dimensions are 132 ft. x 27 ft. 6 in. x 16 ft. 3 in.



Front view of 2,000 b.h.p. two-cycle engine having a bore and stroke of 22½"x45" and running at 100 r.p.m. It is the product of a firm which has engaged in motorship work since 1910

New Model of Well-known Marine Diesel Engine

Two-Cycle Design of Swan, Hunter & Wigham Richardson Is Rated at 2,000 b.h.p. and Weighs 242 Tons; Combustion Space Heat Stresses Minimized

CONSERVATIVE progress is the sure basis for success in all undertakings, in marine Diesel engine construction as in everything else. Information about any kind of machinery is hard to get and does not lend itself to scientific treatment as readily as is generally assumed. Skill in the design of Diesel engines is generally the result of years of patient effort and it has been often found that a successful machine is the product of years of slow, steady growth.

1910 is the year in which the Diesel engine began seriously to cultivate Father Neptune's acquaintance, the opening gesture of which was the commissioning of the Great Lakes freighter TOILER by Swan, Hunter, and Wigham Richardson. The first Diesel to cross the Atlantic had made good.

It will be recalled that the TOILER's twin engines consisted of 4-cylinder two-cycle units known as the Polar and built by the Aktiebolaget Diesels Motorer of Stockholm, Sweden. The results realized induced Swan Hunter to acquire this license for the construction of oil engines.

They believed, however, in making haste slowly and meantime observed the operation of a Mirrlees, Bickerton & Day Diesel-electric alternating current installation put into one of the ships built by them in the year 1913. It was not until 1914 that they came out with a pair of their own engines built substantially according to license and installed in the ARUM, a cargo vessel of 5,000 deadweight tons launched from their own yards.

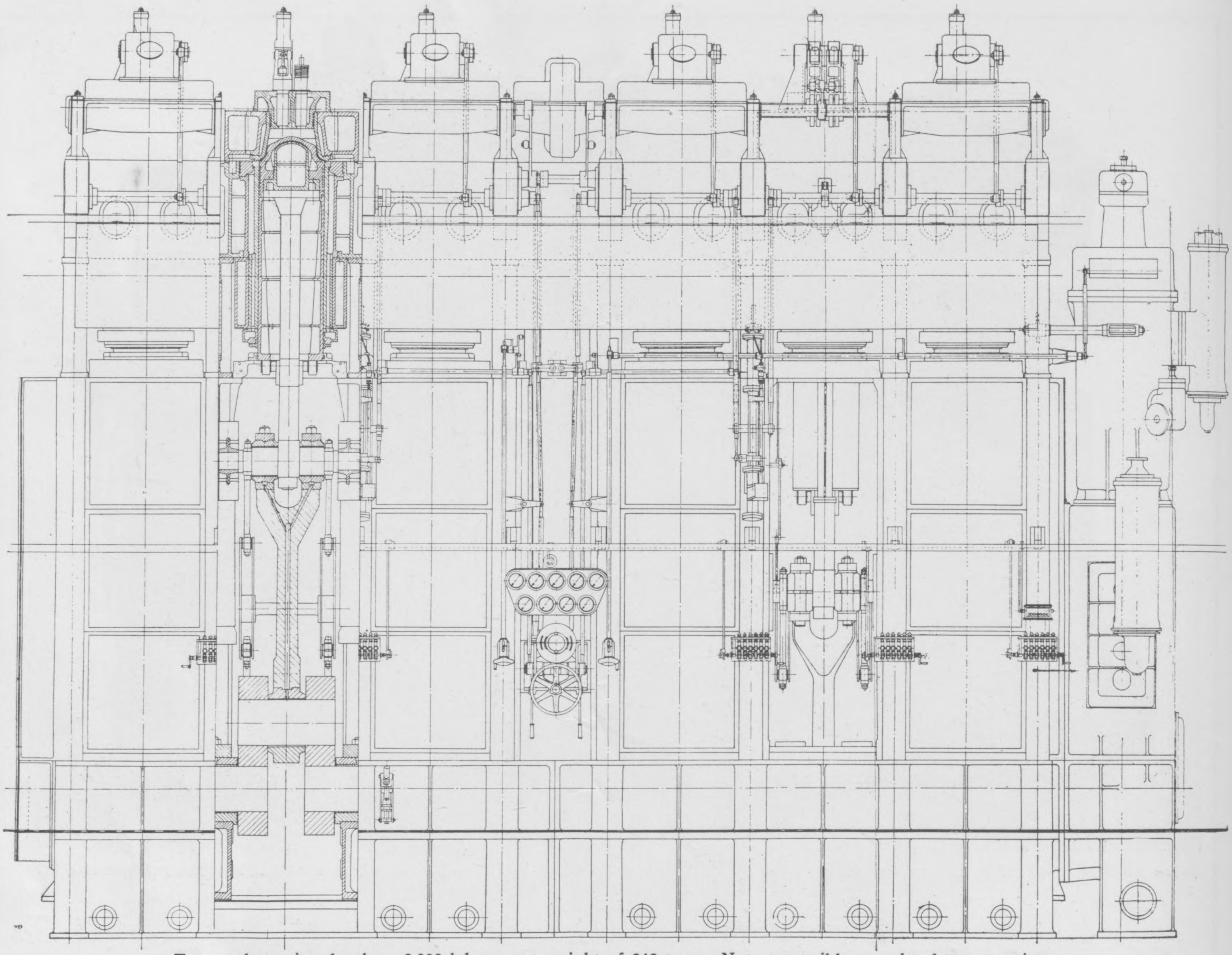
The ARABIS and the ARAMIS followed in quick succession and their satisfactory operation formed the basis for slight modifications in the design of the engines for the Spanish motor tanker ARNUS, described in MOTORSHIP for March, 1923.

Underlying the construction of all these engines is the port-scavenging two-cycle principle, one which is hard to beat for simplicity. The construction of these machines benefits by the elimination of valves, valve pockets, and valve gear, whereas their operation is simplified and rendered more certain by the elimination of moving parts.

Port-admission of scavenging air permits the use of a cylinder head well adapted to resist mechanical and heat stresses and port exhaust makes possible the use of low-grade fuels because there are no valves and ground seats to be kept tight.

Scavenging air has heretofore been supplied in Polar engines by pumps located underneath the working piston extensions, an arrangement which accomplished this important object without the addition of any moving parts outside of the pump valves. The engines could also be conveniently started by admitting compressed air to the scavenging cylinders. There was one constructive drawback to the arrangement and that was that it made the engine about one and an eighth of a stroke length higher than it would otherwise have been.

The 1923 model shows modifications in the cylinder heads and pistons which go a long way towards laying the heat-stress bugaboo and apparently open up the way to the construction of the largest cylinder sizes. Symmetry of form, well shown in the illustrations, is one of the most effective aids there are for giving inherent strength to all kinds of machine members and permits the reduction of metal sections to such



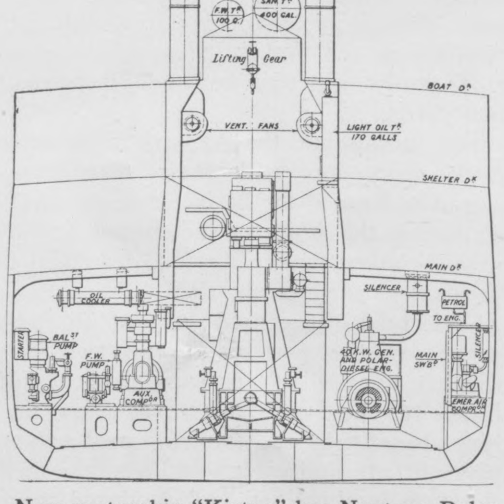
Two-cycle engine develops 2,000 b.h.p. on a weight of 242 tons. Note accessible crosshead construction

an extent that they can readily give up their heat to the cooling water. Particular stress is laid upon this fact in the design of those castings which surround the combustion spaces of oil engines.

Liners embodying this principle have been used in the cylinder heads, if it may truthfully be said that these machines still have them. In addition, the combustion-space liners are held only at the joint between them and the cylinder liners, being sealed off against what remains of a cylinder head by means of ordinary piston rings. Its symmetrical conical form and the resulting thinness of its walls would alone be sufficient to protect it against heat and pressure so that the addition of the sliding joint at the top looks like making assurance doubly sure.

The design of the cylinders and cylinder covers, as shown on the patent diagram, is such as to allow all members subject to high temperatures free expansion in every direction, and to reduce all heat stresses to a minimum. The cylinder is made in two castings, one of which is a beam connecting the cylinders together and taking the gas-pressure load transmitted through the cover and cover casing. It is not in any way exposed to the heat of combustion. The lower casting, which is bolted to the beam, contains the scavenging and exhaust passages, the latter being efficiently water cooled.

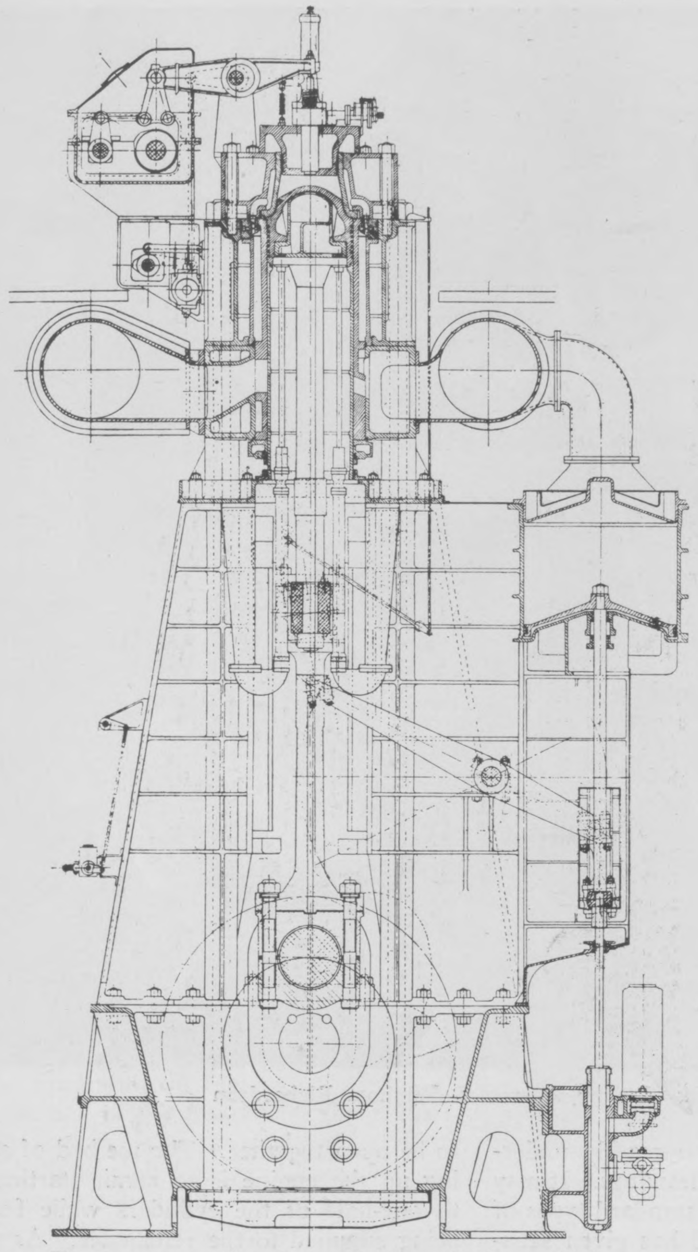
The liner is arranged inside the two castings and is secured in position by a sandwich plate which is cast on the liner some distance below the upper flange and is cut away to form a single ring. By this means an undesirable thickness of metal at the top of the liner, which gives rise to excessive heat stresses, is avoided, the metal being as thin as is consistent with the required strength. Since the sandwich plate is attached to the cover casing by means of studs it can make up the joint between the cylinder and the cover liners.



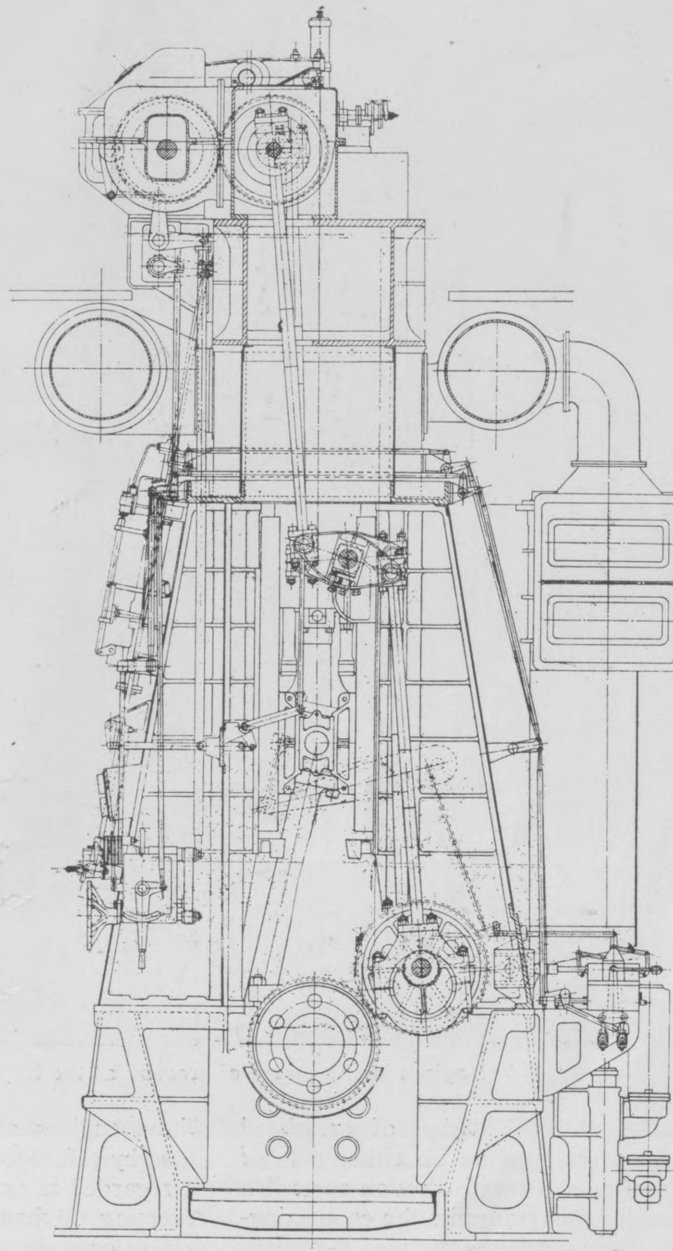
New motorship "Kistna" has Neptune-Polar engines

Possibly it has not occurred to many people that cylinder liners rarely or never crack and the cylinder head here used may be said to have been made by taking a cylinder liner, inverting it, and sealing it off with a plug. Owing to the difficulty encountered in double-acting engines in getting liners and heads that take the up-and-down loads, while at the same time being left free to expand under heat at one end, this new construction has particular significance from the point of view of designing high-capacity double-acting machines. One way of using the new construction for such a purpose is illustrated by the Swan Hunter patent diagram reproduced herewith.

In order to avoid having a water joint



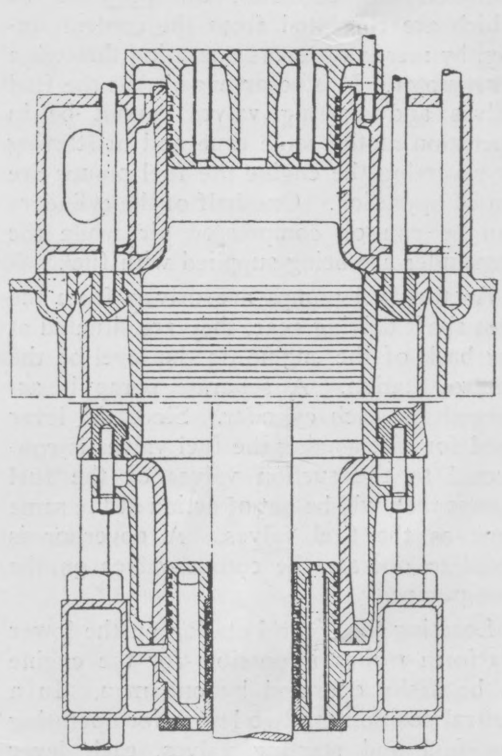
Transverse section through one of the cylinders showing beam-drive for scavenging and bilge pumps. The cylinder-head has crack-proof features



End view of 2,000 b.h.p. engine showing link drive to camshaft by which use of skew gears is avoided

in way of the ports, a water jacket is bolted to the sandwich plate, making a joint at its lower end above the ports. A hollow collecting ring is attached to the bottom of the cylinder liner. The circulating water passes from this ring through holes in the ribs of the liner in way of the ports and into the cylinder jacket. This arrangement provides a very efficient means of cooling the liner in way of the exhaust ports.

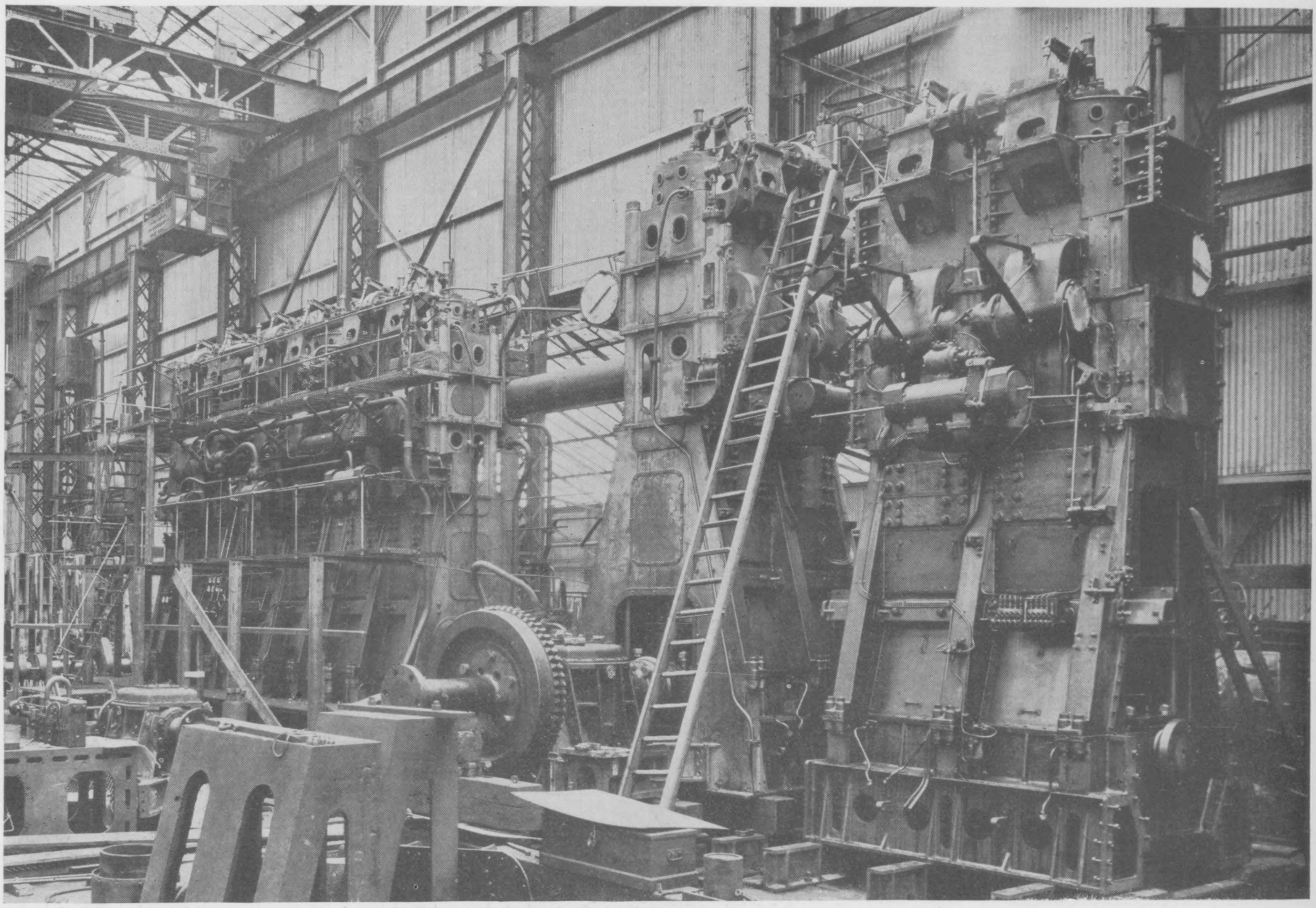
Piston crowns in the new engines conform to the shape of the combustion space and consequently are equally capable of being designed with ample strength without the use of heavy metal sections. As a further means of protecting the piston crown against heat, a water deflector is fitted inside of it, as may be seen in the cross-sectional views. It is readily apparent that this casting causes the piston cooling water to flow at high velocity and in the form of a thin sheet over the inside surface of the crown. Water in active motion abstracts heat from the surfaces which it touches much more effectively than relatively still water and the rapid motion, combined with the low temperature which it insures, practically rules out the deposition of solids.



Showing application of the new design to a double-acting cylinder. All parts subject to combined heat and stress are free to expand

But the piston also has to act as a deflector for the scavenging air to guide it in an upward direction and to make it displace the exhaust gases with a minimum of turbulence and commixture—a function which has also been taken into account in the choice of its outlines. It is interesting to note that the "scavenging edge" of this piston is tangent to the streamlines of the incoming air and that they are deflected upwards without abruptness or discontinuity by the radius in the profile of the piston.

In the new design the scavenging pumps are no longer located under the working cylinders, but are driven off the beam like steam engine air pumps. As a result, starting air is admitted to the working cylinders, an arrangement which harmonizes with the new cylinder head construction. The head, in fact, has been reduced to a mere hollow plug in which the accommodation of fuel and starting valves is rendered particularly easy. By the adoption of beam-driven air pumps and the reversion to the time-tried method of starting on the working cylinders, a lower, lighter, and closer-knit design of engine has been produced.



Engines in the course of erection at the Neptune works of Swan, Hunter & Wigham Richardson

A well-established design of crosshead having shoes and guides on either side of the connecting-rod fork makes an accessible engine casing and transmits the connecting-rod side forces directly to the A-frames. The same pin on which the small-end bearings work is extended beyond them into the crosshead shoes, which are free to turn on them sufficiently to rule out the possibility of cramping. All slides and gibs, not to mention the crosshead bearings are therefore readily accessible without requiring an operator to get inside of the engine.

The camshaft is driven from the center coupling of the crankshaft by means of gear wheels, eccentrics and rods which are in two sets connected by levers mounted on an intermediate shaft having all its bearings adjustable. This gear is the usual Neptune practice and has been adopted in preference to skew gearing owing to its better adaptability for marine purposes.

Reversal is effected by the use of ahead and astern cams mounted side by side in pairs. But both the ahead and the astern rollers that engage with them are mounted on the same link and spaced far enough apart so that the one which is not being used does not strike the top of its cam. It is placed in a different plane, too, so that when it is swung back over the centerline of the camshaft by means of the short link provided for that purpose, it makes contact with its own cam. This arrangement has had considerable application to marine Diesel engines and can be readily understood by reference to the drawings. It may be regarded as one of the standard types of reversing mechanisms and has given satisfaction ever since it was first applied.

Fuel and starting valve levers are mounted on eccentrics, the positions of which are regulated from the control station by means of levers operating through a servomotor. It is so arranged that the fuel valves and starting valves cannot be in operation at the same time and in starting or reversing the engine the fuel pumps are out of operation. One-half of the cylinders can be run on compressed air while the remainder are being supplied with fuel.

As the fuel pumps are driven from the cam shaft driving gear, they are situated at the back of the engine on the level of the control station. A separate pump is arranged for each cylinder. Since the lever used for disengaging the fuel valves is connected to the suction valves of the fuel pumps they will be out of action at the same time as the fuel valves. A governor is fitted to operate the cutout valves on the fuel pumps.

Locating the control station on the lower platform makes it possible for the engine to be easily operated by one man. In a central position are two levers for operating the fuel and starting valves, each lever serving three cylinders. As previously stated arrangements are made so that it is impossible for the starting and fuel valves to be open together. The method of starting up the engine is to admit starting air to one-half of the cylinders while fuel is being supplied to the remainder. As soon as the engine is running the cylinders which were on air are put on to fuel.

A reversing wheel is situated near to these levers and is so arranged that it can only be operated when the starting levers are in the "stop" position. Hand gear is also fitted for the control of the injection air and fuel pumps, and, together with the telegraph and gauges, is arranged in close proximity to the starting levers.

A system of forced lubrication is arranged, the engine being entirely enclosed and a trough is fitted under the bedplate to collect the lubricating oil flowing from the bearings. It is drained into tanks situated in the double bottom and separated from the ship's side to prevent any possibility of sea water leaking in. Lubricating oil coolers, filters and strainers are provided in the system.

The compressor is of the 3-stage, single-acting type, each stage being provided with a straight tube intercooler and separator. A crosshead and guide shoe is provided to take the side loads and to allow of the pistons being outside the crank case.

Beam-driven bilge and sanitary pumps are provided, and are so arranged that any one pump can be used for either purpose and so enable one pump to be overhauled while the other is in use.

Bore and stroke dimensions of the new design are 22½ in. x 45 in. and the 6-cylinder engine is rated to develop 2,000 b.h.p. at 100 r.p.m. As these figures result in a brake mean effective pressure of 73.6 lbs. per sq. in., it is apparent that this two-cycle engine does not fall behind the usual four-cycle machines in the matter of cylinder utilization. This fact and the use of a piston speed equal to 750 ft. per minute has made it possible to produce an engine at a weight of only 242 tons, or 242 lbs. per b.h.p.

In the presence of a large company of visitors an important single-screw steel motorship with an engine of this design was successfully launched on the 24th of March, from the Wallsend shipyard of the same firm, and on leaving the ways the ship was gracefully christened IOSSIFOGLU. She was ordered by the Ionian Marine and Land Investment Co., Ltd., of London, and at the launch they were represented by Mr. Socrates Iossifoglu.

She is being built to Lloyds 100 A.1. class and also has a grain-carrying certificate. She is of the open shelter-deck type with full top-gallant forecastle, and her principal dimensions are, length between perpendiculars 400 ft.; breadth, extreme, 53 ft. 6 ins.; and a depth moulded to upper deck of 28 ft. 3 ins. She will carry about 8,250 tons dead-weight on a reasonable draught.

For supplying steam to the engine-room auxiliaries and deck machinery, two patent Cochran boilers will be provided and they will be fired with oil fuel.

In the hull of the IOSSIFOGLU the cellular double bottom is arranged for carrying water ballast or oil fuel.

The radio-telegraphy room and cabins for the officers and engineers are arranged in houses on the shelter deck at the sides of the engine casing. The seamen and oilers have their quarters in the forecastle.

Besides the installations of Swan Hunter engines built at their NEPTUNE works at Walker, Newcastle-on-Tyne mentioned at the beginning of this article, six additional ones are built or building. Two of them are of the previous model similar to the ARNUS with scavenging pumps underneath and having the characteristics described in previous issues of MOTORSHIP. One of these two is the single-screw motorship KISTNA and has the following dimensions:

A two-cylinder section of a Neptune-Polar engine about to be lowered into the hull of a motorship

Length, o.a.	287 ft.
Length, b.p.	278 ft.
Breadth, moulded	39 ft. 9 in.
Depth (to shelter deck)	24 ft.
Gross tonnage	2,300 tons
Deadweight capacity	1,650 tons
Draught (at above deadweight)	15 ft.

She was recently completed for the British India Steam Navigation Co., Ltd., who will use her for their tropical coastal service.

M/S LUXMI Ready for Passengers and Cargo — INVERBANK, Just Launched, Belongs to the Big Ones

Delivery was made on March 25 of the motorship LUXMI, built to the order of the Bank Line (Andrew Weir & Co.) by Harland & Wolff at their Gowan Shipyard. On that day, also, this shipbuilding firm successfully launched the INVERBANK for the same owners.

LUXMI is the third vessel following her sisters KATHIAWAR and GUJARAT to be delivered to these owners in respect of their recent large order to Harland & Wolff and is a single-screw ship—384′ x 48′ x 36′ with a gross tonnage of about 4,320. She is classed as 100 A.1. at Lloyds, is of the shelter-deck type and complies to the British Board of Trade regulations for passenger service. The GUJARAT was described and illustrated in January MOTORSHIP.

Cargo equipment is up to date. Special steel derricks are used for working the cargo hatches and have a capacity of 5 tons each. Electric drive is used for the ten cargo winches, a warping winch, anchor windlass, steering gear, and in fact all auxiliaries. Good accommodations have been provided for passengers and the first class cabins are heated with electric vapor radiators. The main engine is a six-cylinder Harland & Wolff-B.W. long-stroke unit developing 1650-b.h.p. at 85-r.p.m.

INVERBANK, which is 434′ x 53′9″ x 37′ with a gross tonnage of over 5,200 is the first of a group of twin-screw motorships building for the Bank Line and is appreciably larger than the preceding group, the last of which was delivered on March 26.

The INVERBANK is also of the shelter-deck type, is classed 100 A.1. at Lloyds. Besides two complete steel decks and a boat deck, there is a captain's deck and a navigating bridge. Seven water-tight or oil-tight bulkheads, extending to the upper deck, divide the vessel into five cargo holds, motor room, and fore and after peaks. All the holds are fitted with wide cargo hatches, and No. 3 is arranged to be used either as a deep tank or for the carriage of oil cargo.

Propelling machinery consists of twin six-cylinder Diesel engines, duplicate of the LUXMI's built by Harland & Wolff to Burmeister & Wain designs. Engine-room auxiliaries are electrically operated.

LUXMI and INVERBANK are representative of the two classes of ships which will compose the fleet of 21 motorships built or building for the Bank Line.

Motorship

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Present Position of Ship Conversion Bill

THE bill bearing the official number H.R. 6202, familiarly known as the Edmonds bill, which passed the House of Representatives on April 2d was favorably reported to the Senate by its Committee on Commerce, April 22d, and as we go to press passage of the bill by the Senate is expected daily. Barring those legislative log jams which often attend the closing days of a session, it is likely that this bill will become the law of the land within the next thirty days.

It is the duty of every American shipowner, shipbuilder and Diesel engine builder to thoroughly familiarize himself with the details of this motorship conversion bill in order to be prepared to adjust the conditions which surround this federal aid and take full advantage of the opportunity which it presents.

The Jones bill authorized the Shipping Board to set aside $25,000,000 a year for five years as a construction loan fund. This has been done for three years and of the $75,000,000 so accumulated $9,000,000 has already been loaned, leaving $66,000,000. Of this amount the Edmonds bill authorizes the board to expend $25,000,000 in converting its own vessels to motorships and to loan the balance to private shipowners for the same purpose.

Backed by the unanimous endorsement of the House Committee on Merchant Marine and Fisheries the passage of the bill through the house was aided by the powerful arguments of Congressman Edmonds, ably assisted by Congressmen Davis, Tague, McKeown, Bankhead, O'Connell, Lozier and others. In this connection it is worthy of note that the champions of the bill includes some men from inland states which are supposed to be traditionally indifferent to the merchant marine and a number of men who opposed ship subsidy at the last session.

The opposition came almost exclusively from Congressman Blanton of Texas whose strident vocal solos subside so seldom that his colleagues have ceased to look to him for constructive legislation and have in the past felt the necessity of curbing his loose utterances.

When the final vote was taken in the house 271 members were found to favor the bill against but 29 opposed to it, an ample indication of the importance which this measure has attained in the eyes of our congressmen.

Upon the bill reaching the Senate Committee on Commerce, Chairman Jones with characteristic precaution solicited the views of the Shipping Board on the matter and action was delayed for some time through the failure of the Board to make formal reply to the chairman's letter. It is very difficult to reconcile this with the Board's professed enthusiasm for the measure, but the incident is perhaps only typical of its chronic inability to function effectively.

It is far from a perfect piece of legislation, but its warmest supporters have been in the embarrassing position of not daring to offer radical amendments to it for fear of imperilling its passage and the opinion prevailed that even an imperfect bill was better than no bill at all.

A serious doubt has arisen in the minds of Diesel engine builders away from seaboard as to whether the wording of the original bill which required "construction in private shipyards or navy yards of the United States of vessels, etc.," might not operate to their disadvantage inasmuch as the treasury department has ruled for tariff purposes that engines are not equipment but are part of the vessel. However, in reporting out the bill the Senate committee has inserted the word engines specifically in describing equipment which will, it is to be hoped, clear up this point since it would be manifestly unfair to limit the engines to be installed under this bill to those constructed by companies owning their own yards, excellent though such engines may be.

It is undoubtedly true that except for the irresolution of the ever changing Shipping Board that this important work would have been undertaken long ago. Every Shipping Board chairman from Denman to Lasker has advocated the step, but since Denman's day not one of them has pushed it with vigor.

The bulldog tenacity of Admiral Benson, who has been a staunch, unflinching advocate of this step, will be largely responsible for the success of the present measure. Fighting often single-handed, handicapped by a board whose personnel has changed like a continuous vaudeville, Admiral Benson has clearly sensed the need for motor carriers and pressed for constructive action.

The record of the Board itself in the matter is not an enviable one. Beginning with the ultra-conservatism of Theodore Ferris, beclouded by the unfortunate Denman-Goethals controversy, delayed by the timidity of Edward Hurley and reserved by Albert Lasker for his swan song the plan to equip part of our government built fleet with oil engines has led a hard life. In delaying action to this late date our public officials have given our foreign competitors a clear start and a tremendous advantage and it is to be hoped that the Shipping Board will make amends, tardy though they may be, by rushing actions on its own conversion work and cutting through red tape on the private jobs.

During the debate in the House some members laid great stress on the importance of giving clear authority under the bill for conversion work to be carried on in navy yards as well as private shipyards. This journal believes that the United States should have the best equipped most actively operated navy yards of any first class power in the world, but so little encouragement in other directions is given to those who are trying to keep in operation the facilities necessary for an American merchant marine that it seems "rubbing it in" to endeavor to divert from our private yards the limited amount of business which is available for their sustenance.

The plight of a nation whose shipping policy rests in the hands of country lawyers and farmers is an unfortunate one at the best and, all things considered, it is a remarkable tribute to the breadth of view and courage of a few men like Senator Jones and Congressman Edmonds that they should have been able to clearly grasp the idea presented by Admiral Benson and other supporters of this measure and that they have succeeded in securing favorable action on the part of their colleagues whose roster contains a few bitter enemies of the American merchant marine and many who are wholly indifferent to its fate.

Supercharging

As a means of decreasing the cost and weight of oil-engines, supercharging is commanding an ever-increasing amount of attention from users and manufacturers. Two-cycle engines were the first in which this method was used, but the success which was had with it resulted in its being applied to four-cycle engines. In our March issue we reported the results which have been obtained on a large four-cycle motor vessel and which gives a concrete example of supercharging as actually tried-out and continuously used to improve motorship operation.

What we have already published on this subject in MOTORSHIP, and an article dealing further with the matter which has appeared in OIL ENGINE POWER for March, makes it almost superfluous to call attention again to the sound scientific principles which underlie supercharging and which account for the successes achieved with it. Excess air pumped into internal-combustion engines improves their economy, a fact which is exactly the reverse of what happens when excess air is allowed to leak into a boiler setting. In the case of the latter the heat stolen by the unnecessary air and even by the inert constituents of the air such as nitrogen, have been regarded so important that proposals are now being considered for producing pure oxygen cheaply and using it for boiler firing.

Needless to say the artificiality of such a method for improving economy in the generation of steam has some unwholesome features about it and is just one more illustration of the desperate straits into which steam engineers are being forced by the competition of the economic oil-engine. The dilution of air for boiler firing, although admittedly wasteful, is also an effective protection of the setting and tubes against overheating. It is common knowledge that if the bed of an ordinary coal fire is allowed to become punctured in one spot and to form a blow-torch flame, serious damage is almost certain to result to some part of the furnace or tubes. How much more then will be the effect of intense temperatures which will result from applying oxygen to the fire?

Exactly the reverse is true of supercharging as applied to internal-combustion engines. Owing to the high ratio of expansion and the large temperature drop which is used in the Diesel and oil-engine cycles generally, the relative effect of excess air is insignificant, and the few B.T.U's. which are stolen by the air that is not used up for combustion are made good several times by the improved economy which results from completer combustion. As we have shown in our articles, supercharging air manifests itself directly in decreasing fuel consumption and in lowered cycle temperatures, and it may be stated, without hesitation, that the overloading of an internal-combustion engine which is made possible by the use of excess air works in the direction of sound operating technique, while the only means known for increasing boiler ratings can only have a tendency to do harm.

We have shown that the extra horsepower added by the supercharging blower to an oil-engine was purchased at a cost of $4, and a weight of six pounds per indicated horsepower, figures less than one-tenth of the expense and weight of the original engine. As a means for still further reducing oil-engine first-cost and operating charges, this is a method which is bound to be increasingly studied and applied in the developments immediately before us.

Interesting Notes and News From Everywhere

World's Record of New Construction, Ships' Performances and Other Matters of Note in the Motor-Vessel and Oil Engine Industries

DAN KING of Vancouver is reported ordering a 100 h.p. 4-cylinder Skandia oil engine to be installed in a small tow boat.

POLARHAVET, a 6,450-d.w. tons motorship with Burmeister & Wain engines has been acquired by the Forenede Dampskibsselskab.

MEDITERANEE NORD, is the name that has been given to the passenger motor-liner building for the Services Construels of the Messageries Maritimes.

A motor tug propelled by a 450-b.h.p. Vickers-Petter oil engine has been launched for the Ports and Lighthouses Administration of Alexandria, Egypt.

Atlas-Polar Diesels of 500 s.h.p. have been ordered for installation in two 1,000 tons d.w. motorships by the Bergenske Steamship Co., Bergen, Norway.

The Deutsche Werft single-cylinder four-cycle Diesel engine, in which supercharging of air has been incorporated, and referred to last month, is of the double-acting type.

A. P. Allison of Vancouver, B. C., recently secured a hull of the cannery tender type and installed a 2-cylinder 50 b.h.p. Washington-Estep Diesel, besides having extensive alterations made.

LO OLBEE is the name of a 65-ft. gasoline passenger launch which is operated by the Harbour Navigation Co. of Vancouver and whose engine will be replaced by a 60-h.p. three-cylinder Mianus oil engine.

"Diesel and Semi-Diesel Engines," written by G. Vaillot and published in Paris by Dunod, was erroneously referred to as costing $9.00, in our April issue. The price is $9.50. Procurable through our office.

During the German Marine Conference held in Berlin on April 7th and 8th, Dr. Carl Commentz spoke on Technical-economic Questions Concerning Motorships. It is hoped that a report of his address will be available for publication at an early date.

The fleet of Bruusgaard, Kiosterud & Co., Drammen, Norway, including the motor-tanker HAMLET, aggregates 85,510 d.w. tons with an average age of 5¾ years. It was built at a cost of 209 kroner per ton, or $55.17 at the current exchange rate.

A "Program Expanded for Marine Simplification" adopted by the American Marine Standards Committee under the auspices of the Department of Commerce includes Standard Elementary Instructions for the Care and Operation of Diesel Machinery.

It is our understanding that 18 of the fleet of Diesel engine motorships ordered by Andrew Weir's Bank Line from Harland & Wolff, cost £95,000 per vessel or $413,250, at current exchange rates. The other three vessels cost £85,000 or $369,750 each.

Halibut fishermen are beginning to take a good deal of interest in oil engine power. Another 50 h.p. Skandia engine is reported going into a fishing vessel at Prince Rupert, while Capt. Burrows of North Vancouver is putting the same power in his fishing boat.

On page 260 of MOTORSHIP for April, 1924, we erroneously referred to a "Goodyear-Cutless" rubber bearing. There is no such thing since the only firm which is putting a rubber submerged bearing on the market is the B. F. Goodrich Company of Akron, Ohio. What we should have said was "Goodrich-Cutless."

To the order of the Swedish East Asiatic Company, a 10,000 tons d.w. motorship

named NANKING was recently launched at the Gotaverken yard, Goteborg. Twin 2,000 i.h.p. Gotaverken—B. & W. Diesel engines are being installed and the speed of the ship will be 12½ knots.

The motor yacht PRINCESS, which will be propelled by twin Sulzer engines at a speed of 14 knots has been launched at the shipyard of the Furness Shipbuilding Co., Ltd. Her dimensions are 200 x 30 x 16 ft.

Vickers, Ltd., prominent builders of marine oil engines have never operated at a loss during any of the 27 years since they started business in 1897. At that time their assets were £4,000,000 and at the end of 1922 they were £35,000,000.

Through his agents, Lester & Sundt A/S, Wilhelm Wilhelmsen of Tonsberg, Norway, has ordered another 6,400 tons d.w. twin-screw motorship from the Deutsche Werke A. G. She will be propelled by twin four-cycle engines of 1,000 b.h.p. each.

Arrangements to build motorships are now being made by the Frederiksstad Mek Verksted, of Frederiksstad, Norway. As yet the type of Diesel engine has not been decided, but the necessary shops will be commenced shortly. Here would appear to be an opportunity for an American firm to dispose of a Diesel manufacturing license.

Proposals for the propelling machinery of the 788-ft. 40,000-gross tons liner of the Compagnie Generale Transatlantique are being considered. It is reported that a large Copenhagen firm is submitting bids for Diesel engines to equip this vessel, which would be placed in the Havre-New York service.

SILVERELM and SILVERCEDAR are being built at Doxford Yards, England, to the order of the Roosevelt Steamship Company of New York City. They are of 8,000 tons d.w. each and will be propelled by three-cylinder opposed piston Doxford two-cycle airless injection engines developing 2,200 i.h.p. at 90 r.p.m.

Motor towboat "Listo" jogs along at a good clip when not towing. She has an oil engine now

Additional reports just received on the towboat LISTO, sister of the VIVO, both of which were listed in our previous issue as belonging to the Wilmington Transportation Co., show that she made a speed of 12 miles per hour on her trial trip. She is powered with a four-cylinder Union airless injection engine, which recently replaced a 135-b.h.p. open-crosshead gas engine of the same make. The latter had been in constant service for a number of years and had to make room for the newer propelling unit solely because of the big economies that can be realized with the heavy-oil engine. The illustrations at the top and bottom of this page give a clear idea of the construction of the LISTO, which is of a representative type. Applications of this modern type of work-boat power are multiplying at such a rate that it will become increasingly difficult to keep up with them as time goes on.

The Marine Oil Engine Trials Committee, whose appointment was referred to in these pages, has begun the work of making impartial tests on the engines of five British engine builders, aggregating 9,450 b.h.p. Announcement has also been made that sea trials will also be conducted, but publication of the results so far obtained are being withheld for the present.

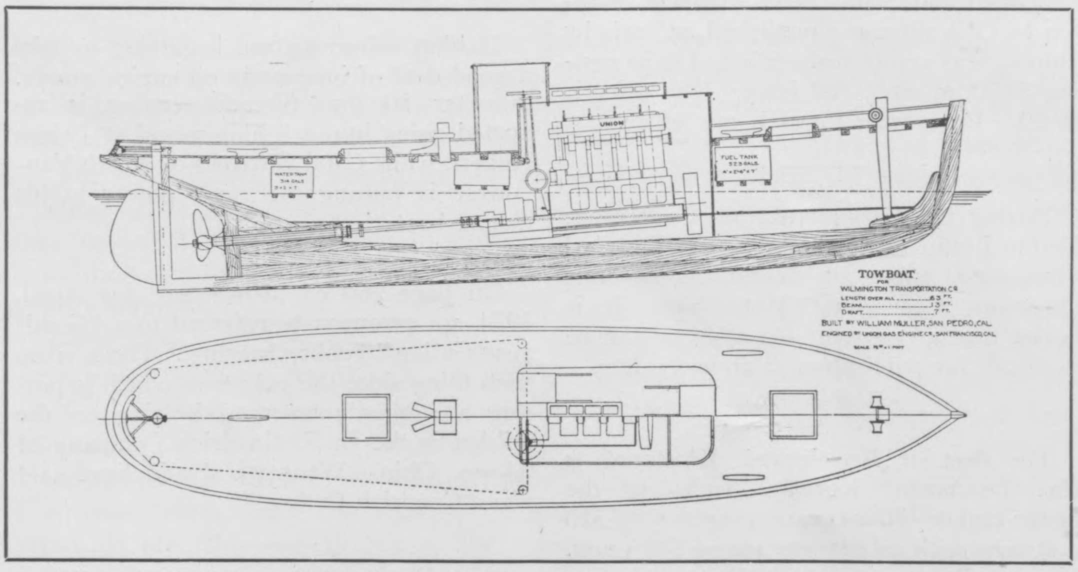
INNAREN is a new motorship hull built by Langesunds Mek. Verksted and sold by them to A. B. Gotaverken. She has recently been towed to the Gothenburg plant of the latter firm and will be equipped by them with Burmeister & Wain type Diesel engines. She is 330 ft. long, 50 ft. broad and 26 ft. 7 in. deep and will have a carrying capacity of about 6,000 tons.

A 60-foot halibut fishing schooner built by Eriksen Bros. to the order of Capt. Geo. Fritz of Prince Rupert at North Vancouver is being fitted with an 80 h.p. 2-cylinder Skandia semi-Diesel engine. The dimensions of the new boat are 60 feet o.a. 16 feet beam and 8 feet moulded depth. She is being built of fir and will be used for halibut fishing out of Prince Rupert, B. C.

An unusual motor yacht is the SEA KING, which has two funnels side by side, each one being fitted with specially-designed spark arresters. The hull was built under the owner's personal supervision without the services of a naval architect and contains a workshop intended solely for the owner's use. She is propelled by twin Vickers-Petters surface-ignition oil engines of 440 b.h.p. each.

In our February issue a statement was published to the effect that machinery had been ordered for two more Diesel-electric ferries. We have been advised by H. E. Speas, Vice-President of the Golden Gate Ferry Co., of San Francisco, that originally electric motors were ordered for two ships but since has been changed to a set for one ship. No contract has been placed for the hull or for the Diesel engines.

LA MAREA, the United Fruit Company's newest motorship, is a sister-vessel to the LA PERLA and the LA PLAYA, which was described in November MOTORSHIP for 1923 and referred to in our March, 1924 issue. These three ships are all equipped with



Oil-engined towboat "Listo." A glance at the section of her keel shows that she is built for business

Cammellaird Fullagar Diesel-electric propelling machinery. The LA MAREA left Birkenhead on April 12, and arrived in Boston on April 26.

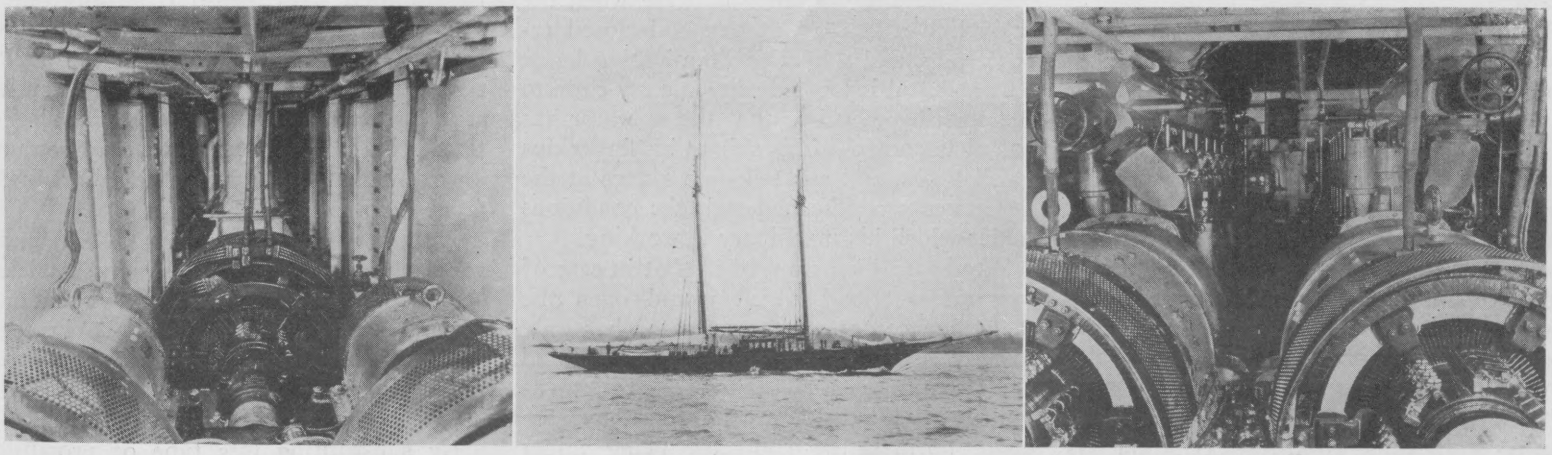
A single cylinder 1,000-b.h.p. double-acting four-cycle Diesel engine of Werkspoor and North Eastern design is undergoing tests at the shops of the North Eastern Marine Engineering Co. of Wallsend-on-Tyne. There is only one piston in each cylinder and it is attached to a piston rod passing through a water-cooled stuffing box in the usual manner. This machine is just 18 inches higher than a corresponding steam engine of the same power.

Regarding the twelve motorships "ordered" out of a fleet of sixteen ships in Great Britain for Australian service, we understand that they will have a speed of 16 knots and a length of 465 feet. In addition to accommodation for 150 first-class passengers, space has been provided for 3,600 tons of chilled and frozen beef. It is hoped that a loan will be made under the Trade Facilities Act. A cable received after closing for press with our last issue stated that the orders have not been definitely placed due to the matter of financing.

Of the three motor tank barges built and building at the Camden plant of the New York Shipbuilding Company, the first one arrived in New York on April 18, and will proceed up the Hudson after taking on a cargo at Long Island City. She is propelled by twin McIntosh & Seymour engines of 350 b.h.p. each. Five additional sister vessels are under construction at the Sun Shipbuilding Company's plant at Chester, Pa., and the first one of this batch is now undergoing trials. The total capacity of the Diesel propelling machinery for these eight vessels is 4,200 b.h.p.

A hull of the cannery tender type named ALCO has been secured by A. P. Allison of Vancouver, B. C., and he is installing a two-cylinder Washington-Estep Diesel engine of 50 b.h.p., besides having extensive alterations made to the boat to fit her for log towing and log buying at Seymour Inlet. The overhauling and installation of the engine was done by the Vancouver Machinery Depot. This engine has a bore of 8¾ inches and 12½-inch stroke, and develops its power at 325 r.p.m. On her trial run the ALCO made about 8½ knots turning a propeller of 42-inch diameter and 38-inch pitch. The boat is about 50 feet over all, 12-foot beam and 6-foot draft.

H. A. Jones of Vancouver, B. C., is having a 75-foot Diesel-engined tug boat built by the Vancouver Shipyards Ltd. from designs by T. Halliday. The principal dimensions are 75 feet o. a., 16 feet 6 inches beam and 9 feet moulded depth, with 8 feet 8 inches draft. This tug is being built of fir principally, with sawed frames and will be equipped with a 220 h.p. 4-cylinder Polar Diesel turning a 4-bladed propeller of 78 inch diameter at 230 r.p.m. A 14 h.p. auxiliary engine is direct connected to a dynamo and belted to a shaft, off which the air compressor and salvage pump are run. The boat will be steam heated throughout, from a heating boiler placed in the engine room. Fuel tanks with capacity of 4,000 gallons are located forward of the engine room. The accommodations are very good for a tug of her size and include a spare cabin for the owner's use.



Diesel-electric drive replaced steam on the "Cutty Sark" and made a good arrangement in the stern peak of the vessel

Diesel Electric Drive for Auxiliary Sailing Yacht

Fine Lines of Stern Would Have Hindered the Use of Other Machinery. H. C. Coleman, Westinghouse Marine Engineer, Describes Winton-electric Installation

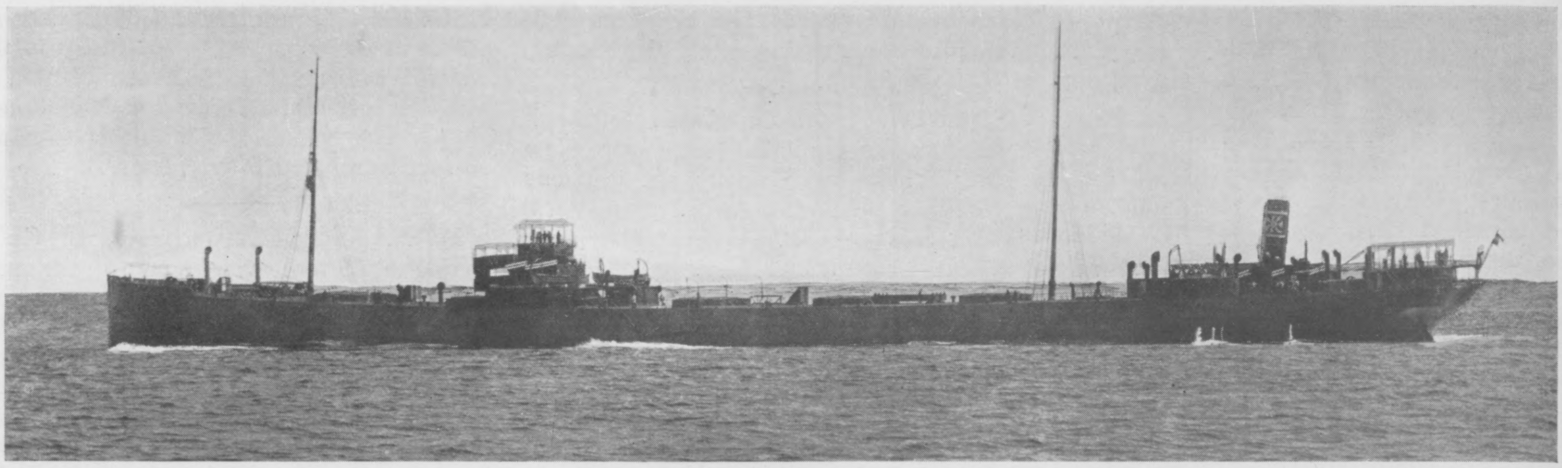
OWNERS of yachts have for some time realized the many advantages of using electrical appliances, in a small way, on their vessels. The number and variety of applications has gradually increased until within the last three years this development has extended to the propelling machinery so that we now have complete electrically-equipped craft, thoroughly modern in every way. The propelling machinery of these new yachts is of the Diesel electric type consisting of medium or small Diesel engines driving electric generators which supply power to a propelling motor. The engines rotate always in one direction of rotation and at full rated speed while the propeller speed and direction of rotation is controlled electrically through the propelling motor.

The latest vessel to be fitted with this type propulsion is the CUTTY SARK, formerly the ADRIADNE, an auxiliary schooner yacht owned by A. W. Smith of New York. The work of installing her new machinery was recently completed at the yard of the Morse Dry Dock Co. in Brooklyn. She is 131 ft. long, 26 ft. beam, and has a gross tonnage of 246, and draft of 19 feet.

This yacht is equipped with two main generating sets, each consisting of a 100 B.H.P., 6-cylinder Winton full Diesel engine, direct connected to a 65 KW, 125-volt, 600 R.P.M. Westinghouse generator and a 7 KW, 125-volt exciter, a 150 H.P., 250-volt, 240 R.P.M. Westinghouse propelling motor; and complete control equipment.

As will be seen from the illustrations, the generating sets are very small and compact and lend themselves very well to installation in the engine-room of such vessels where the space is limited by the fine lines and by the necessity of obtaining as much room as possible for quarters. The generator, exciter and pedestal bearings are specially arranged for mounting on an extension of the rigid engine base, thus providing a self-contained unit which maintains its alignment and which is easy to place and secure to the ship's structure. The exciter armature is pressed on an extension of the main generator shaft and the outboard bearing for the latter is made sufficiently large to support the overhung exciter armature. This eliminates the necessity for an outboard bearing on the exciter and so makes a shorter unit.

The propelling motor is of the single-unit type. The supporting feet are arranged as near the horizontal center line of the field



The motor tanker "Zoppot" which is the largest in the world and which has put up such a remarkable performance during the last three years, outlined on the page opposite

frame as possible in order to fit the frame down into the hull which is very restricted at this point. The armature is carried in two short pedestal bearings which are supported on cross members secured to the ship's framing. The terminals on the motor, as well as on generators and exciters, are arranged at the tops of the field frames and the cables are led directly up to the deck above, along the under sides of which they are carried forward to the switchboard.

Both the propulsion and the auxiliary switchboards are located in the control room which is directly above the forward end of the engine-room. The propulsion board is mounted in the forward end of this room and carries the control equipment for the main generator, exciters and propelling motor. The usual Ward Leonard control system is used. The two generator armatures are connected in series to the propelling motor armature, through a main line magnetic contactor, by means of double-throw knife switches.

The motor shunt field is separately excited at a constant value from the excitation bus which may be supplied by either exciter. The generator shunt fields are connected in parallel to the reversing rheostat which is supplied with power from the excitation bus. This rheostat, which might be called the master controller, is of the double-face-plate type so constructed and arranged that with the contact arms in the neutral position, no voltage is impressed on the generator fields. When the arms are moved in one direction, voltage is applied to the fields in thirty steps from zero to full voltage in one direction. When the arms are moved the opposite way from the neutral position, the polarity is reversed and voltage again gradually applied. Thus the generator voltage is varied in direction and intensity by this rheostat and since the motor field is separately excited at a constant value, its speed will vary in direct proportion to the generator voltage, neglecting saturation.

The reversing rheostat is mounted in the rear of the propulsion switchboard and is operated through shafts and bevel gears from a handwheel on the front of the board or from a control pedestal located directly above the wheel house. Normal operation will be from this pedestal so that the pilot will have complete control of his propelling motor. The lever on the pedestal moves forward through an angle of 45 degrees from the vertical position to the full speed ahead point, and back a similar distance from the vertical position to the full-speed-astern point, with 30 speed points each way.

The small panel on the top of the pedestal carries a generator and motor voltmeter, line ammeter, an indicator showing the R.P.M. of the propelling motor, a red and a green indicating lamp to indicate when the main line contactor is open and closed respectively, and a hooded illuminating lamp. The pedestal is located conveniently close to the steering wheel so that the operator has complete control of his ship at his finger tips at all times, and can tell by a glance at the instruments on the pedestal, the conditions under which his machinery is working.

The control is arranged so that in case of extreme overload which would open the main line contactor, the operator has only to move his control lever back slightly and the contactor will automatically reclose as quickly as the voltage conditions have become normal, the contactor being under control of suitable relays.

Switches are provided so that either main generator may be cut out of circuit and still allow for operation from the other set. This gives an economical cruising speed and makes a very flexible plant, for, in case of trouble with one set, the ship can be operated at about 75% speed from the other while repairs are being made on the disabled one. Thus the chances for complete shutdown are very remote. Main switches, with interlocked field switches are also provided so that either main generator may be connected to the auxiliary power bus to supply ship's auxiliaries and appliances at such times as the excess capacity of the exciters, over that required for excitation, is not sufficient. The interlocked field switches automatically transfer the generator field connection from the reversing rheostat to standard regulating rheostats, when the main switch is closed to connect the generator to the auxiliary power bus. The generators still operate as separately excited shunt machines in this case, taking power from their respective exciters. Only one of the generators may be connected to the bus at one time.

The auxiliary switchboard is located on the port side of the control room. It carries controls for a 5 KW, 125-volt auxiliary generator, battery charging control, bus transfer switches and all feeder switches for the various auxiliary and lighting circuits.

It will be seen that maximum flexibility has been provided. The bus layout and interconnecting switches are arranged so that lights and most of the auxiliaries may be supplied with power from any one of four sources, namely, either main generator, either exciter through the excitation bus, the auxiliary generator or the storage battery. A switch is provided so that in an emergency power may be taken for excitation of the propelling machinery, from the auxiliary generator.

Under normal conditions when under way, the exciters will supply sufficient power for lights and auxiliaries so that only the main generating sets will be in operation. When the main sets are shut down, the auxiliary set will be used and at night, the storage battery only.

By substituting this type of propulsion machinery for the old steam engines as outlined on page 22 of the 1924, January issue, it was found that considerable space could be gained for quarters and much needed passage-ways, so that the general layout and arrangement of the yacht was greatly improved. When we consider the additional advantages obtained, such as greatly increased cruising radius due to the much more economical Diesel engine, reduction in the engine-room force due to elimination of the boilers, etc., cleanliness, decreased vibration, power supply permitting the use of convenient electrical appliances throughout the ship, refinement of control, and increased safety because the propulsion control is placed in the hands of the pilot and because there is so little chance of a complete shut down of the plant, we see why this system is finding so much favor in this field, as well as on many other types of vessels. Similar installations have been made on the schooner yachts Elfay, Guinevere, and Alcoyne as well as on the Valero II which is a power yacht. All of these vessels have given excellent service, which is traceable to the excellence of their power and transmission machinery.

What a Motor Tanker Can Do

The "Zoppot's" Three-Year Record is Practically Continuous

It often has been stated that because of the necessary quick turn-rounds, Diesel propulsion for tankers is unsuitable. Repairs and adjustments were believed to be too numerous each voyage to enable a vessel to enter port, load or discharge cargo and leave within 48 hours. This may have been the case ten years ago when the oil-engine taken as an average did not possess the degree of reliability it has today, when many motor tankers are putting up performances equal to or better than steam tankers. This is the case of the ZOPPOT, the largest tanker in the world, operated by the German interests of the Standard Oil Company.

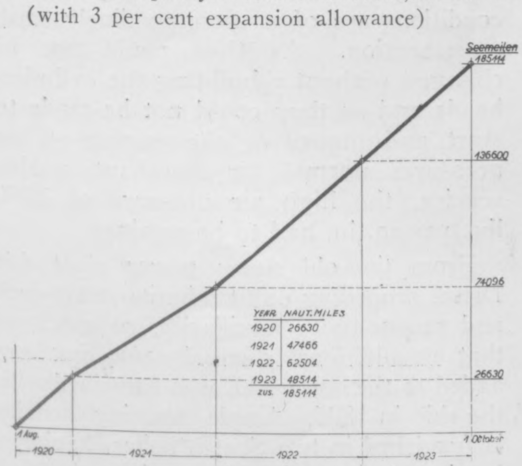
Krupps, builders of this 15,750 ton d.w. Diesel-driven Isherwood system ship, claim that the vessel has covered the greatest mileage run up to now by any motorship in continuous service during a similar period, and that her twin 1,600 shaft h.p., six-cylinder, two-cycle Diesel engines have been kept in operation for a longer period than any other high-powered marine oil engine.

This vessel was fully described in MOTORSHIP of 1920, page 796. She is owned by the Baltic American Import Co., Danzig, and started on her maiden trip from Kiel to New York on July 31st, 1920. Up to October 1st, 1923, or a little over three years' service, she covered a total mileage of 185,114 nautical miles. Her average speed was 10.5 knots. The figures probably make favorable comparison with the most successful of steam tankers.

The ZOPPOT is now owned by Standard Oil interests. Originally she was named WILHELM A. RIEDEMANN, and was owned by the German-American Petroleum Company, of Hamburg, also a Standard Oil subsidiary. She has the following dimensions.

Loaded displacement	22,000 tons
Length (O. A.)	545 ft. 0 in.
Length (B. P.)	525 ft. 0 in.
Breadth	66 ft. 3 in.
Depth to shelter-deck	41 ft. 3 in.
Depth to main-deck	33 ft. 6 in.
Dead-weight capacity	15,750 tons
Draught	27 ft. 9 in.
Metric-capacity	15,227 metric-tons
Total cargo-capacity	693,329 cu. ft.

(with 3 per cent expansion allowance)

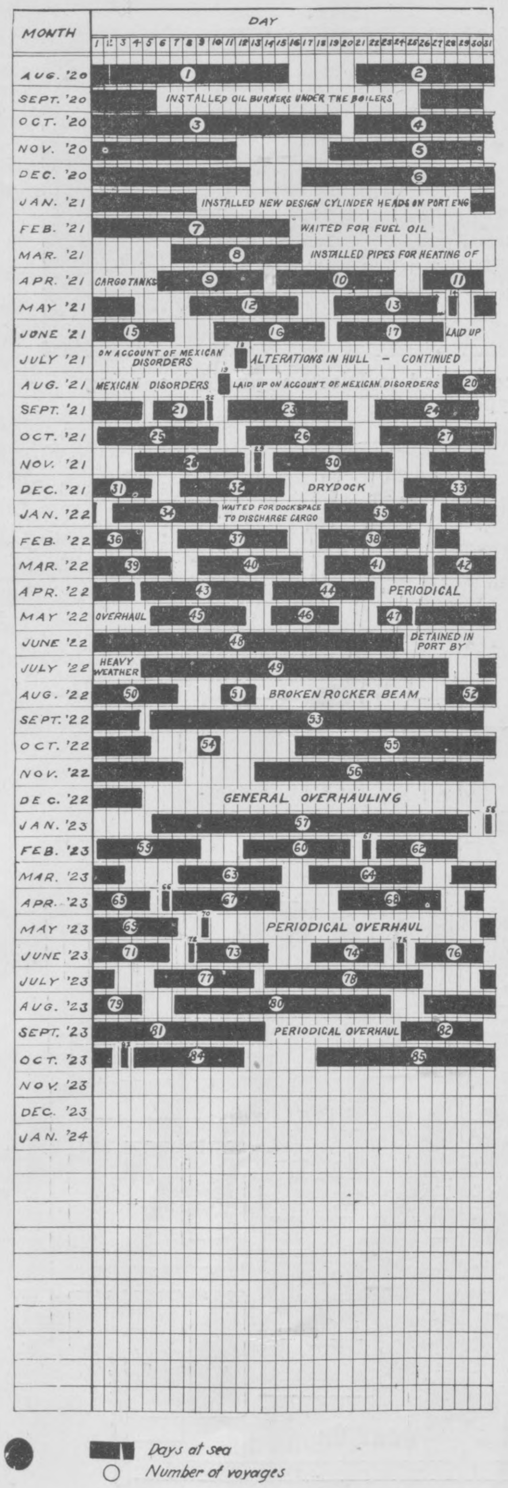


There are no breaks in the "Zoppot's" yearly mileage.

Power	4,000 indicated h. p.
Number of cylinders	6
Bore and stroke	575 mm. by 1,000 mm.
Designed engine-speed	106 R. P. M.
Trial speed	12 1/5 knots
Average speed (light)	11½ knots
Daily fuel-consumption	12 to 13 tons
Fuel consumption	0.305 lb. per i. h. p. hour

Being a tanker the engines are naturally installed aft. Because of the limited amount of cargo that an oil-tanker can carry on given dimensions there naturally is plenty of room for the engines. By reason of their smallness in size there is "room to burn," and while the two-cylinder, three-stage compressor on each engine is driven by an extension at the forward end of the crankshaft, a span of about 6 ft. between the compressor and the engine has been allowed in order to provide a gangway through.

As a motorship operating in the severest class of service there is, the ZOPPOT has established a record which amazes even steamship men now but which will soon be a matter that passes without comment in marine circles.



Operation Chart of Diesel-driven Tanker "Zoppot."

VOYAGE	KNOTS PER VOYAGE	TOTAL KNOTS	FROM	TO
1	3854	3854	KIEL	NEW YORK
2	3962	7816	NEW YORK	HAMBURG
3	5394	13210	HAMBURG	BATON-ROUGE
4	4990	18200	BATON-ROUGE	ROTTERDAM
5	5056	23256	ROTTERDAM	BATON-ROUGE
6	5046	28302	BATON-ROUGE	ROTTERDAM
7	2470	30772	ROTTERDAM	PONTA DELGADA
8	2276	33048	PONTA DELGADA	NEW YORK
9	2081	35129	NEW YORK	MATA REDONDA
10	2057	37186	MATA REDONDA	NEW YORK
11	2066	39252	NEW YORK	GUAYABALILLO
12	2027	41279	GUAYABALILLO	NEW YORK
13	2065	43344	NEW YORK	TAMPICO
14	83	43427	TAMPICO	MATA-REDONDA
15	1957	45384	MATA REDONDA	BALTIMORE
16	2069	47453	BALTIMORE	MATA REDONDA
17	2056	49509	MATA REDONDA	BALTIMORE
18	177	49686	BALTIMORE	NEWPORT NEWS
19	177	49863	NEWPORT NEWS	BALTIMORE
20	1833	51696	BALTIMORE	BATON-ROUGE
21	899	52595	BATON-ROUGE	MATA REDONDA
22	39	52634	MATA REDONDA	TUXPAN
23	2024	54658	TUXPAN	NEW YORK
24	2062	56720	NEW YORK	CHORRERA
25	2021	58741	CHORRERA	NEW YORK
26	2065	60806	NEW YORK	CHORRERA
27	2023	62829	CHORRERA	NEW YORK
28	2073	64902	NEW YORK	TAMPICO
29	78	64980	TAMPICO	CHORRERA
30	2022	67002	CHORRERA	NEW YORK
31	2018	69020	NEW YORK	CHORRERA
32	2020	71040	CHORRERA	NEW YORK
33	2070	73110	NEW YORK	CHORRERA
34	2034	75144	CHORRERA	NEW YORK
35	2020	77164	NEW YORK	CHORRERA
36	2034	79198	CHORRERA	NEW YORK
37	2056	81254	NEW YORK	CHORRERA
38	1960	83214	CHORRERA	BALTIMORE
39	1944	85158	BALTIMORE	CHORRERA
40	1966	87119	CHORRERA	BALTIMORE
41	1999	89118	BALTIMORE	CHORRERA
42	1955	91073	CHORRERA	BALTIMORE
43	2002	93075	BALTIMORE	CHORRERA
44	2029	95104	CHORRERA	NEW YORK
45	2011	97115	NEW YORK	TACOMATE
46	899	98014	TACOMATE	BATON-ROUGE
47	651	98665	BATON-ROUGE	CHORRERA
48	6356	105021	CHORRERA	B.A. ROADS
49	6347	111368	B.A. ROADS	TACOMATE
50	2017	113385	TACOMATE	NEW YORK
51	494	113879	NEW YORK	NEW YORK
52	2052	115931	NEW YORK	CHORRERA
53	6698	122629	CHORRERA	RAKALATE
54	260	122889	RAKALATE	B.A. ROADS
55	6148	129037	B.A. ROADS	BATON-ROUGE
56	5002	134039	BATON-ROUGE	HAMBURG
57	5433	139472	KIEL	TAMPICO
58	81	139553	TAMPICO	CHORRERA
59	1923	141476	CHORRERA	BALTIMORE
60	1964	143440	BALTIMORE	TAMPICO
61	81	143521	TAMPICO	CHORRERA
62	2005	145526	CHORRERA	NEW YORK
63	2667	148193	NEW YORK	MATA REDONDA
64	2009	150202	MATA REDONDA	NEW YORK
65	2067	152269	NEW YORK	TAMPICO
66	81	152350	TAMPICO	CHORRERA
67	1913	154263	CHORRERA	SPARROWS P.
68	1970	156233	BALTIMORE	CHORRERA
69	1917	158150	CHORRERA	BALTIMORE
70	126	158276	BALTIMORE	NEWPORT NEWS
71	1850	160126	NEWPORT NEWS	TAMPICO
72	81	160207	TAMPICO	MATA REDONDA
73	1442	161649	MATA REDONDA	CHARLESTON
74	1482	163131	CHARLESTON	TAMPICO
75	81	163212	TAMPICO	CHORRERA
76	1921	165133	CHORRERA	BALTIMORE
77	1982	167115	BALTIMORE	MATA REDONDA
78	3122	170237	MATA REDONDA	MONTREAL
79	1334	171571	MONTREAL	NEW YORK
80	3954	175525	NEW YORK	BIZERTA
81	4453	179978	BIZERTA	NEW YORK
82	1991	181969	NEW YORK	TAMPICO
83	81	182050	TAMPICO	CHORRERA
84	2017	184067	CHORRERA	NEW YORK
85			NEW YORK	BUENOS AIRES

Oil companies that have not yet adopted Diesel power for their tankers should study the above performance record of the Diesel tanker "Zoppot" and compare it with the operation of their own vessels.

Oil Engines Replace Steam Power on Passenger Liner

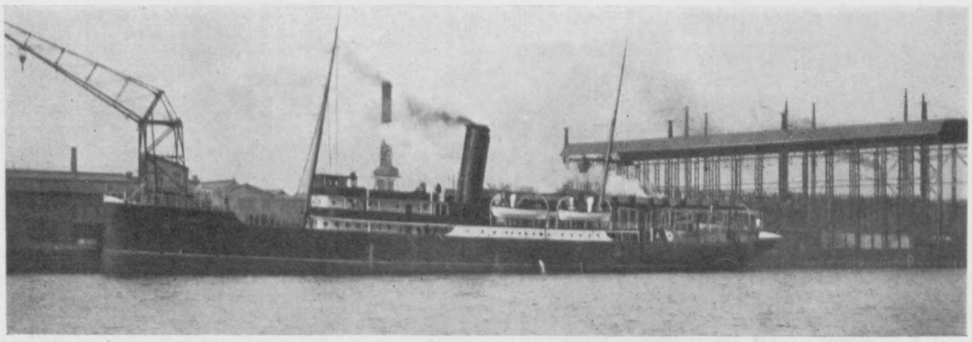
Twin 3,000-b.h.p. Submarine Diesel Engines Will Have Direct Drive and Will Be Rated at 1,400 b.h.p. and 200 r.p.m.

REFERENCE has already been made in our September 1923 issue to the passenger steamship, J. J. SISTER, which is owned by the Compaña Transmediterranea of Barcelona and which is now undergoing conversion to Diesel power at the shipyard "Fijenoord" of Rotterdam, Holland.

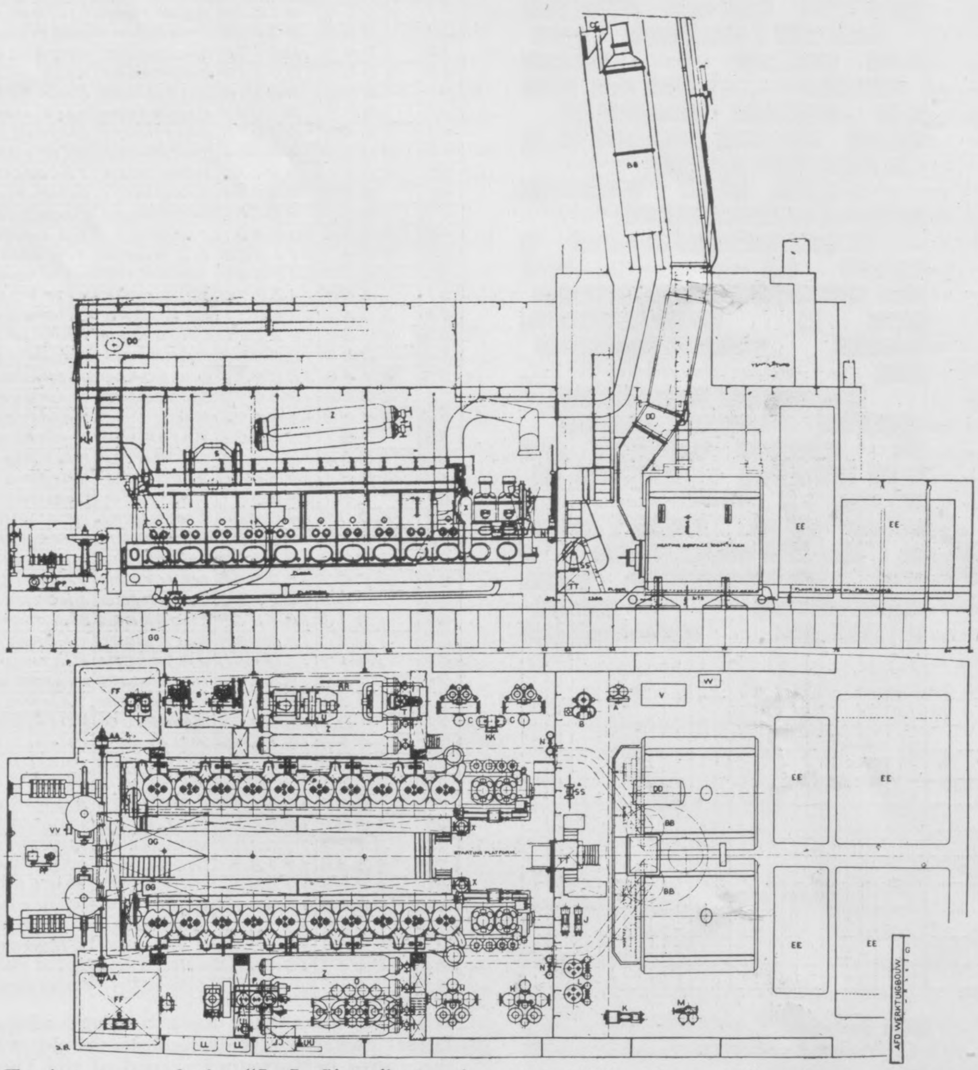
During our correspondent's recent visit to this vessel, it was noted that the engines have already been installed on their foundations and that the plant will shortly be put into operation. Particular interest attaches to this ship because she is quite old, having been built in 1896 by Nicolo Odero of Genoa, and were it not for its staunch construction, the work that is being done on her might suggest the old "saw" about putting new wine in old bottles.

As we have already stated, she was propelled by two triple-expansion steam engines, each developing 2,095 i.h.p. at 110 r.p.m. and imparting a speed of 17½ knots at full power. The old propelling plant, over which the Diesel engines to be installed will shortly be able to show operating economies, formerly consisted of two double-ended Scotch boilers, having eight furnaces and working at the wastefully low pressure of 146 lbs. per sq. in.

Corrected reports on the Diesel installation, which we have just received, state that the new plant will consist of two Diesel engines of the submarine type and will be direct connected to the propeller shafts. The Diesels are of the 10-cylinder, 4-stroke, single-acting, trunk-piston type, having a square bore and stroke of 530 m/m (20.86 in.) and developing 3,000 b.h.p. each as originally rated. Because of the direct connection of the propeller shafts, these machines will turn up only 200 r.p.m. instead of the 375 at which they were run for submarine propulsion. They are expected to develop 1,400 b.h.p. each under these conditions, and thus produce an installation somewhat different from those of the HAVELLAND and the ERMLAND, vessels in which the same size and type of engine is used but fitted to run at a little higher speed, namely, 230 r.p.m., giving 1,750 b.h.p. each, in connection with reduction gearing.



Steamship "J. J. Sister" which has been converted to Diesel-engine drive, using submarine-type units



Engine-room of the "J. J. Sister" showing two 1,750 s. h. p. submarine-type Diesel engines. Also arrangement of donkey-boilers and fuel-tanks

Descriptions of this type of submarine engine are so well-known that it is hardly necessary to go into great detail concerning them. The use of cast-steel gives these engines a distinct character, which is already pronounced because of their being originally intended for submarine service. There are three parts to the crankshaft—the two outer sections of which have five throws and the middle one a single crank for the air compressor.

Naturally, trunk pistons are used and the oil cooling system fitted to them has been carefully worked out to avoid seizures. No swinging links are used and oil-tightness of the telescopic tubes feeding oil to the piston crowns is insured by means of traveling stuffing boxes.

Hydraulic reversing is the system used on this engine and appears to be a trifle more sluggish than that generally found on Diesel engines. The time required for reversing from full ahead to full astern is 30 seconds. Four-stage air compressors supply air for injection purposes and charge starting bottles at 2,270 lbs. per sq. in., a pressure which betrays in no uncertain manner the naval characteristics of this power plant. High storage pressures are imperative on a submarine for economizing space and the starting valves fitted to the engine cylinders to handle air under these conditions are of a correspondingly small cross-section. As they could not be changed without rebuilding the cylinder-heads and as they could not be made to start and maneuver the engine on air pressures normal for merchant marine service, the high air pressure of 2,270 lbs. per sq. in. had to be retained.

From the old steam power plant this Diesel propelling outfit inherits steam-deck and engine-room auxiliaries, so much so that an additional steam-dynamo has been added to the one which was furnished with the ship in 1896. Ample steaming capacity is furnished in two Scotch boilers having a heating surface of 1,100 sq. ft. each.

As a result of the smaller power which

is being installed the speed of the ship will be reduced to 14½ knots. Smaller propellers having a diameter of 9 ft. 10 in. and a pitch of 8 ft. 8½ in. will replace those formerly used, which had a diameter of 12 ft. 2½ in. with a pitch of 20 ft. ⅜ in.

Both the hull and the Diesel engines were obtained at exceptionally low prices, a fact which accounts for the antediluvian arrangement here described. It appears as though it would require a big saving in interest charges to pay for the fuel which the big steam boilers will waste. Ripping out boilers and replacing them with more modern motor auxiliaries would undoubtedly cost more than the particular patching process to which they are being subjected at the moment when the Diesels are being installed, but the chronic repairs which a 28-year old steam plant will continually require should also be included in the comparison.

According to figures actually realized and recorded on the converted steamer SEEKONK (March issue, page 183) her Diesel-electric auxiliaries saved $30,000 annually, an amount which would alone contribute substantially to the cost of ridding the J. J. SISTER's hull of the antiquated, money-eating trap which now encumbers it.

More Double-Acting Diesels

When on our trip to Europe last summer we were advised by the builders that a double-acting Diesel engine of the four-cycle type was being constructed at Wallsend-on-Tyne, jointly by the North Eastern Engineering Company and by Werkspoor of Amsterdam. Upon the success of the trials of the first single-cylinder 1,000 horsepower unit rested an order for a single-screw motorship to have a 7,000 h.p. engine of this design. We have since heard that at the Amsterdam plant of Werkspoor experiments are now being carried on with a double-acting Diesel engine, also of a 1,000 h.p. per cylinder, but of the port scavenging two-cycle type. Evidently these veteran Dutch Diesel builders are determined to keep abreast with all stages of development in this industry.

Preliminary trials of the first four-cycle double-acting unit were run at the beginning of April at Wallsend before several visitors. It was not then developing its full load, but about 800 h.p. at 95 r.p.m. Stress is laid by the designers on the fact that the engine is of the direct-acting type, the distinctive feature being the direct transmission of power from a single double-acting piston through one piston rod to the crank, similar to the usual steam engine, but this Diesel is only 18 in. higher. However, no additional head-room is required for lifting the cylinder covers or examination of the pistons, so the head-room advantage rests with the oil-engine. The pistons can be examined without breaking the top joint or raising the cylinder head.

Double-Acting Two-Cycle Engine for M. S. Swanley

New Ship is First One to Have Sliding Cylinder Engine Giving Two Power Impulses per Crank and per Revolution

BUILT to the order of Harris & Dixon, the single-screw North British engined motorship SWANLEY was successfully launched from Barclay, Curle, & Co.'s Clydeholm shipyard at Whiteinch on March 22nd, with an impressive launching ceremony. She is the ship referred to on page 263 of April, 1924, MOTORSHIP, in connection with the complete description there given of the 2,000-b.h.p. North British double-acting two-cycle oil engine which will be her propelling unit.

The vessel is a single deck ship, having complete shelter deck, and full topgallant forecastle, and is noteworthy on account of the fact that she will be the first vessel built in England to be equipped with double acting Diesel engines.

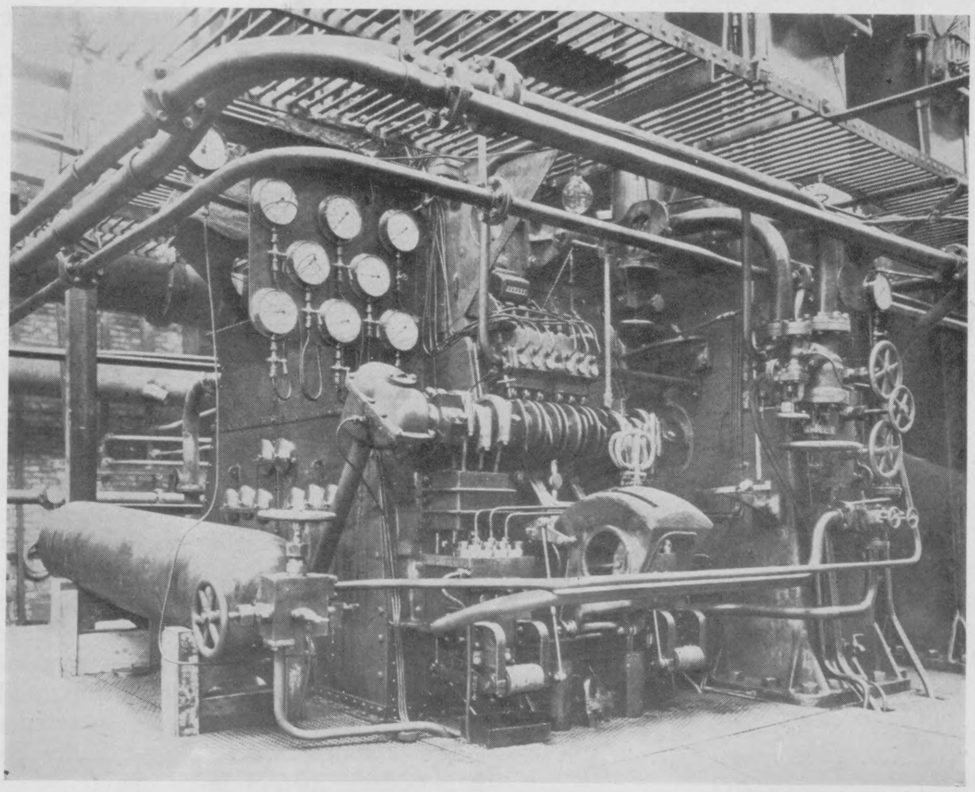
Her dimensions etc. are as follows:—

Length	410 ft. 0 in.
Breadth	55 " 3 "
Depth moulded to upper deck	29 " 0 "
Deadweight	9200 tons
Gross tonnage	6700 "
Speed	11 knots.

A steel centre-line bulkhead is fitted in the holds with portable shifting boards in way of the hatches, for the carriage of grain; feeder trunks being installed from the weather deck. All the double bottom ballast tanks, except tank under the main engines are arranged for oil fuel or water, and the White circulating system is installed in the oil fuel tanks. Another special feature, not usually found in cargo vessels, is the provision of a duct keel in which is accommodated the bilge, etc., piping. As is usual in modern high-class cargo carriers, the vessel is electrically lighted, and is equipped with wireless apparatus.

The main engine has three cylinders which are 24½" diameter by 44" stroke and develops 2,000-b.h.p. at 100 revolutions per minute. Since it receives a working impulse on the top and bottom of the piston at every stroke, exactly as does a steam engine, it can naturally obtain a given horsepower on small dimensions and weight. This engine, which is now about to be placed on board the vessel, has run a long series of experimental trials extending over several months with satisfactory results. Its fuel consumption will be about 9¾ tons of oil per day, as against about 35 tons of coal used by a steam engine of equivalent power.

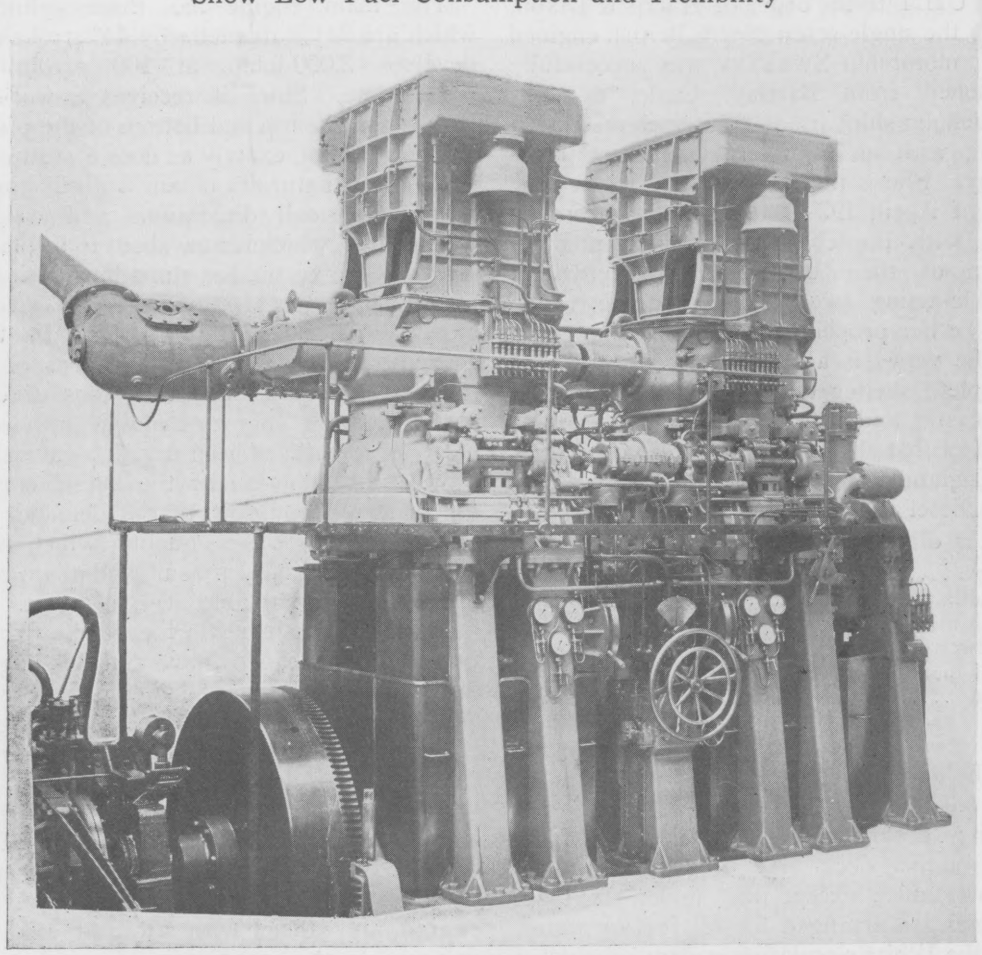
It has sometimes been urged, as a reason against the adoption of the Diesel engine for marine propulsion, that it demands an oil of special Diesel quality which was dearer than ordinary fuel oil, and might possibly not be obtainable at every port. In their recent experiments the North British Diesel Engine Works have run this engine on fuel oil of ordinary boiler quality with a specific gravity of 17° Be'. The engine has burnt this oil with complete success, and the results would appear to show that no such limitation of quality as has up till now obtained in the matter of Diesel engine fuel supplied, need be applicable to this new type of engine with its straight through scavenging and absence of air and exhaust valves. At the great majority of ports in the world, ordinary fuel oil can, of course, be bought at a cheaper rate than the refined Diesel quality oil, so that this consideration is one of some importance to British shipowners, not only in the securing of supplies of fuel readily, but also in the matter of running costs.



Control station of double-acting two-cycle engine installed on the Harris & Dixon motorship "Swanley"

Test of 3,000-b.h.p. Diagonal-Rod Opposed-Piston Engine

Shop Tests of Large Six-Cylinder Unit for Single-Screw Vessel Show Low Fuel Consumption and Flexibility



Three pairs of opposed-piston cylinders like the two shown here will be mounted together to form one engine on the "British Aviator," making her the highest-powered single-screw internal combustion engined vessel afloat

BRITISH AVIATOR is the name of the British Tanker Company's bulk oil carrier which will shortly enjoy the distinction of being the highest-powered, single-screw, internal-combustion-engined vessel that sails the seas. As we pointed out briefly in the preceding issue, she will have a Palmer-Cammellaird-Fullagar direct drive six-cylinder Diesel engine capable of delivering a maximum continuous output of 3,000 b.h.p. This power would be realized at a speed of 90 r.p.m. but for steady seagoing service the ratings will be set at 86 r.p.m. and 2,750 b.h.p.

The hull is practically completed and shop tests have already been successfully conducted under the supervision of Professor Hawkes, an occasional contributor of technical articles to MOTORSHIP. Since this is the first model to be constructed in so large a size, particular interest attaches to his findings.

Results of fuel consumption tests include the power necessary for driving the scavengers, forced lubrication, and piston and jacket water-cooling pumps. The consumptions measured are as follows:

1/1 Load	0.405	lbs. per b.h.p.-hr.
3/4 "	0.404	" " "
1/2 "	0.422	" " "
1/4 "	0.463	" " "

Opposed pistons are used in these engines and diagonal rods and arranged on each pair of cylinders in such a way that a simple 180-degree two-throw crankshaft may be employed for each pair. Four pistons therefore act on each section of crankshaft located between two main bearings with the result that the engine can be made short and compact. February MOTORSHIP contains clear cross-sections of this type.

A wide speed range and good maneuvering flexibility was disclosed on the tests.

WORKBOAT ENGINE 12 YEARS YOUNG

Soldered and Plugged Outside, Good as Gold Inside; Economy Not Seriously Affected by Old Age

A GOOD example of how the small marine oil engine stands up to hard work and wear is found in the Gosse-Millard Packing Co's cannery tender CHINA HAT which operates on the British Columbia coast. The CHINA HAT is 55 feet overall by 14 foot beam, and is used during the salmon fishing season as a cannery tender and fish carrier, and during the remainder of the year in general towing, being steadily employed practically the whole year round. She is equipped with a four-cylinder Fairbanks-Morse two-cycle oil engine developing 60 h.p. at 400 r.p.m. This engine is said to have been working in the CHINA HAT for 9 years, and for three years previously in the cannery tender JINKS, having been one of the first of these engines installed on the B. C. coast.

After receiving her spring overhaul at Vancouver, B. C., this year she has now started out on another season's work. The principal signs of wear or age show on the outer walls of the water jacket where several leaks have had to be soldered or otherwise plugged. Since this is apparently due to corrosion from salt water circulation, it might have been avoided by using fresh water for cooling the cylinders, a method which has been adopted for some of the marine gasoline engines. This system will be used in at least one of the marine Diesel engines to be installed at Vancouver this year.

The engineer of the CHINA HAT stated that the engine was doing good work and though not so economical as when new was driving the boat at 8 knots on a fuel consumption of 3½ imperial gallons an hour and a gallon of lubricating oil every three hours.

The CHINA HAT has a Fairbanks-Morse horizontal-type, stationary oil-engine on the forecastle head, driving a cargo winch; this winch being available also for heaving up the anchor.

Although the lubricating oil consumption of the propelling engine has become a trifle high as the result of long years of service, its cost would still hardly exceed 20 cents per hour. Fuel oil costing 5½ cents per gallon would add 19 cents to this bringing the total expense to 39 cents per hour. Since the consumption rate of a brand new gasoline engine would be about the same, the expense for its fuel, at 23 cents per gallon, would amount to 80 cents per hour, with a bill for lubricating oil on top of that. What this would amount to depends on the make and age of the gasoline engine.

A total of 12 years' steady running is reported for the oil engine of this boat and only superficial overhauls are known to have been made

Italian motorships have increased 570 per cent since 1914, according to LA MARINA ITALIANA.

Our Readers' Opinion

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed)

From North of the Tweed

To the Editor of MOTORSHIP,

With reference to your two publications, MOTORSHIP and OIL ENGINE POWER, would it be possible for you to send to Mr. Stewart Pollock your copies as they come out each month? He considers your publications to be the best printed and that they contain some of the most valuable information of any publication of a similar kind in the world to-day.

WILLIAM C. POLLOCK,

W. & S. Pollock & Co.,
Cambuslang, Scotland.

A Valuable Sales Factor

To the Editor of MOTORSHIP,

We wish to compliment you on a most interesting as well as valuable publication in MOTORSHIP. This not only holds good as far as engineering data is concerned, but is of value to a Sales Department in a concern like ours on account of editorial and news items which are strictly abreast and sometimes ahead of the times.

P. E. KRIEBEL,

Sales Manager,
American Engineering Co.,
Philadelphia, Pa.

One of the Many

To the Editor of MOTORSHIP,

MOTORSHIP is a very interesting journal and I'm always anxiously waiting for the next number.

ALBERT H. AMHAUS.

Detroit, Mich.

Electric Reversing for Diesel Engines

To the Editor of MOTORSHIP,

In the November issue of MOTORSHIP you described the new 1,700 h. p. McIntosh & Seymour Diesel engine and in this description you made the statement that reversing an engine, laying camshaft and other operations are being done by means of an electric motor, and that this arrangement is novel and true American. However, the writer wants to call your attention to the fact that we did exactly the same thing in Germany on the engines on the SECUNDUS which was published and described in the "Zeitschrift Des Vereines Deutscher Engenieure" in 1914.

In this connection it may be mentioned that Siemens-Schuckert Works had to develop a special rheostat so that the motor could be thrown in as quickly as the controller could be moved by hand and not as is customary on D. C. motors to start the motor slowly. After knowing this fact, it will be quite interesting for you to read over your article on quoted engine since almost the whole text of this article deals with this one feature as being new in the line of engineering.

H. SCHRECK,

Lombard Governor Co.,
Ashland, Mass.

Mr. Schreck is correct in what he says and the matter was an oversight on our part. It will also be recalled that on one of the Tosi Diesel engines described in MOTORSHIP six years ago, an electric reversing machine was installed. EDITOR.

To the Editor of MOTORSHIP,

I hope the following facts concerning the operation of the Diesel-electric dredge TEXAS and the fuel which this dredge is using, will be of interest to you.

This vessel, belonging to the Long Bell Lumber Co., of Longview, Wash., and designed by the writer some six months ago, has a 15 in. suction and discharge. The main power plant is a 525 h. p. Werkspoor Diesel-engine which drives a 360 k. w. 2,300 volt, three phase, 60 cycle, alternating-current generator. All operating equipment is motor driven from this central power plant.

The TEXAS has been working steadily without interruption for the past six months, using 13 barrels of "boiler-feed oil" for a 24-hour operating day. The fuel-oil used is that regularly furnished by the Standard Oil Company, of California, in this district and known as "boiler fuel-oil." Its specific gravity varies from 17 degrees to 18 degree Beaumé, the average being about 17½ degrees. The flash-point is not less than 150 degrees Fah. This is guaranteed not to contain more than 2 per cent bottom sediment and moisture.

Once a week this engine is started and shut-down on what is called "Diesel oil" which has a gravity of 27 degrees plus Beaumé; all other operation is with the 17 degree oil. The engine runs perfectly on this fuel and no difficulty is experienced with the exhaust valves. The operating engineers prefer using the heavier oil, claiming there is more natural lubricant left in the heavy grade of oil than in the lighter Diesel oil.

JAMES H. POLHEMUS.

General Manager,
The Port of Portland,
Portland, Oregon.

The World's Largest Diesel Engine

To the Editor of MOTORSHIP:

I am taking this opportunity to correct a typographical error, which I regret to say was not corrected in the manuscript which was sent to you last.

On page 18 is a table of consumption of fuel and lubricating oil, which should read:

> "The hourly fuel consumption of the entire installation (main engine)—3.000 kg. (not 30,000 kg.)"

The remaining figures remain unchanged; however, I would like to make the suggestion that they be supplemented by the following additional data, which will also interest the readers of your periodical:

> "The scavenging pump drew in per hour, 62,000 cubic meters. The compressors drew in per hour, 5,000 cubic meters."

The power for driving the scavenging pump was 1,650 h.p.; that for the cooling pumps was 100 h.p., while the two compressor engines developed 1,600 to 1,800 indicated horsepower.

F. ENGLERT.

Chief-Engineer,
Nurnberg Plant of M.A.N.,
Nurnberg, Germany.

Swedish Motorship Album

Remarkably well illustrated and attractively gotten up catalogs concerning the history and products of Aktiebolaget Gotaverken, Goteberg, Sweden, have just been received.

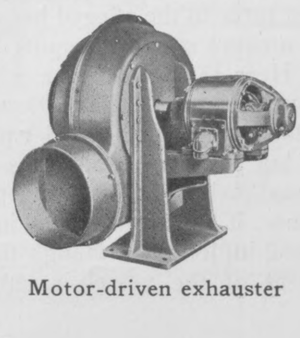
Twenty-six vessels, having a tonnage greater than 500, have been built by this firm since 1912, and the illustrations which are given form an impressive record of the progress which the motorship has made.

The description of the ships and dry docks is most interesting and shows that this shipyard is among the foremost of the world as regards modern and efficient methods.

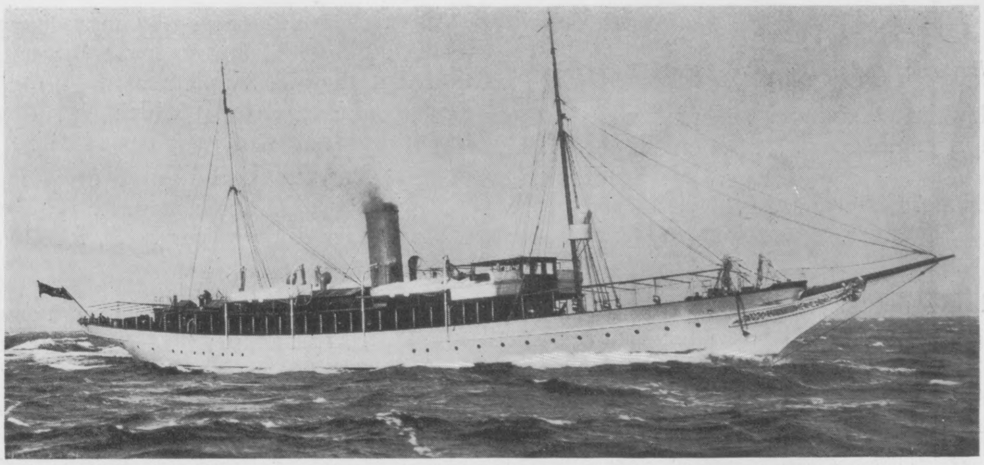
They have always built motorships according to Burmeister & Wain license, and all the vessels which they have put to sea have enviable operating records to their credit.

Exhauster for Motorships

During our recent visit to the auxiliary sailing yacht CUTTY SARK we were impressed by the fact that good use can be made on motor-vessels of a small exhauster of the type shown. In operating a Diesel engine there are two sources of odors and gases—one of them being unburnt fuel oil which through leakage comes in contact with exhaust valve cages and other heated parts and the leakage of burnt gases from exhaust pipe connections. The positive removal of these gases is conducive to the good health of the operating crew and is particularly desirable on an elegant pleasure vessel like the CUTTY SARK because it eliminates the necessity of cluttering up her promenade decks with ventilators and cowls.



Motor-driven exhauster



"Naz Perwer," a fast, graceful yacht belonging to Prince Youssouf Kamal, is on her way to Egypt. Her 1,700 b. h. p. Sulzer Diesel engines are pushing her along at 15 knots in the face of a stiff breeze

Princely Yacht Sets Out Under Oil Engine Power

NAZ PERWER, whose particulars and trials have been recorded in these columns, has been fully commissioned and has left Leith for Alexandria, Egypt, to be within easy reach of her owner, Prince Youssouf Kamal, who resides at Cairo. She is scheduled for a cruise around Africa, starting by the Suez Canal and finishing via the Mediterranean. Her twin 850-b.h.p. Swiss Sulzer Diesel engines make her one of the fastest motor yachts afloat at present, but she may soon be outrivalled.

A Japanese Motorship With Opposed-Piston Oil Engines

In previous issues we have referred to a motorship of 9,150 tons d.w. now under construction at the Kawasaki Dockyard to their own order, in which will be installed a Cammellaird-Fullagar type opposed-piston Diesel engine now building under license on the Clyde at the plant of John Brown & Company. This ship has the following dimensions:

Loaded displacement	12,700 tons.
Light displacement	3,550 tons.
Cubic capacity of holds and 'tween decks (grain)	494,000 cu. ft.
Capacity of fuel bunkers	1,200 tons.
Fresh water capacity	120 tons.
Deadweight capacity	9,150 tons.
Weight of main engines	330 tons.
Weight of complete engine-room machinery with propeller, shafting and auxiliaries, ex. cooling water	550 tons.
Donkey-boiler pressure	350 lbs.
Length of machinery space	44 ft. 2 in.
Power (indicated)	3,600 h.p.
Power (shaft)	2,500 h.p.
Number of engine-room crew	11
Cylinder bore and piston stroke	22"x33"
Engine speed	98 r.p.m.
Propeller diameter, pitch and area	16'3"x14'3"x850'

Naval architects not in favor of Diesel-drive often refer to the alleged heavy weight and large amount of room required for machinery. Here is another case which contradicts such claims. This Diesel engine will develop 3,600 i.h.p. at 98 r.p.m. on a weight of but 330 tons or 550 tons complete with all auxiliaries, shafting and propeller. Furthermore, it will be installed in a space only 44 ft. 2 in. long. Although the loaded displacement of the vessel is only 12,700 tons, the cubic capacity of cargo in the holds is 494,000 cu. ft. of grain.

RIO BRAVO and RIO PALUCO are the names of the two new motorships building for the Ozean Linie.

Twin Burmeister and Wain Diesels will be installed in a motorship ordered by Alfred Holt & Co. from Scott's Shipbuilding Co. of Greenock.

It is reported that the Associated Oil Co. has placed an order at a cost of $119,000 for a Diesel electric-driven barge, with the Moore Dry Dock Co., of San Francisco.

BENSON FORD, second of the two motorships for the Ford Motor Company, was launched last week at the Great Lakes Engineering Works, Detroit. She is due to enter service about July 15th.

The Port of Portland Commission, Oregon, is stated to have placed an order with the Wallach Equipment Co., of Seattle, and the Hesler Machine Works, of Portland, for a Diesel electric-driven dredge with a contract price of $180,000.

The duty on oil engines for use in the fishing boats of British Columbia has been suspended, and as a result over 4,000 craft of all kinds have been made available for this type of propulsion. American manufacturers are in a particularly favorable position to take advantage of this enticing opportunity.

Motorship for Danish Coastwise Service Economy on Short Routes Shown

The United Shipping Co. of Copenhagen, was quick in following the lead of the Danish pioneer motorship concern, the East Asiatic Co., ordering soon after the maiden voyage of the motorship SELANDIA, its first Diesel-vessel, CALIFORNIA, and later operating a fleet of motorships on oversea routes. For the first vessel they specified steam-driven deck machinery, but afterwards adopted the superior electric system.

It is a matter of significance that this company has entered upon the policy of replacing the steamers by motorships in their small vessel fleet, particularly as it has no access to fueling at the cheap export harbors. It is, by the way, interesting that their four big transatlantic motorships do not bunker when abroad, but take their supply from the import companies at Copenhagen.

What made the management of the United Shipping Co. decide in favor of a motorship service replacing the small steamer trading between Copenhagen and Odense, the largest Danish provincial town, was the lower operating cost in port of Diesel-electric deck machinery compared with steam during the weekly loading and discharging. Bids for the Diesel ship ordered worked out at 15 per cent within those for a corresponding steamer. But the company sees an advantage as long as fuel-oil does not cost more than four times coal, the present prices per ton being 100 and 40 Danish kroner respectively. The oil-fuel consumption in port is figured out at one-tenth that of coal.

The United Shipping Co.'s new small motorship is being built by their own Helsingfors shipyard, and is the first Diesel-vessel to be built by the Helsingfors yard. The power plant will also be supplied by a concern in which the shipping firm has a controlling interest, viz., the Danish Diesel Works, Ltd., formerly the Holeby Co. in which business also Burmeister & Wain, the East Asiatic Co. and the Copenhagen Floating Dockyard are interested.

The vessel is of the following main dimensions:

Length, b. p.	180'
Breadth, o. a.	31'
Moulded depth	13' 6"
Deadweight tonnage	575 tons
Capacity of holds	40,000 cu. ft.

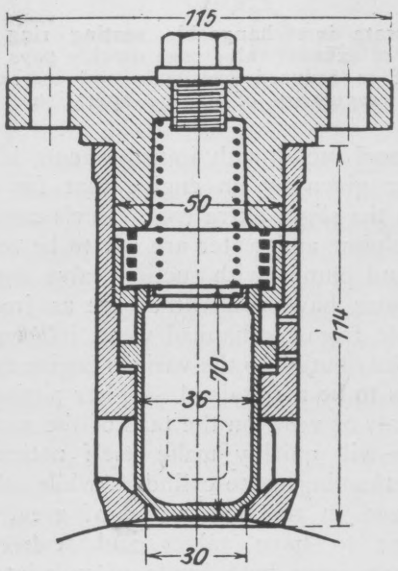
Fuel will be carried in bottom tanks, and the motorship is expected to be delivered next October. The engine installed is being built at Holeby, under license from Burmeister & Wain, and is of 500 b.h.p. at 150 r.p.m. It will be of the six-cylinder, trunk-piston four-cycle type.

Nickel and Its Alloys Applied to Oil Engine Parts

Cast Iron Is Improved by the Addition of From Three to Five Per Cent of Nickel and Monel Metal Reduces Maintenance on Valves

SO reliable is the operation of the modern oil-engine, that little is known about efforts to increase this valuable property still further. But they are being made, nevertheless, and by the use of the most modern technique it has been possible to prolong the life of oil-engine parts, whose renewal at stated intervals is regarded as ordinary operating routine. Most of the parts that go to make up an oil-engine have a practically indefinite life, and these include by far the largest and heaviest members such as bed-plates, framing, connecting-rods, camshafts and cylinder-jackets. By neglect or accident these parts never wear out and bring down the overall depreciation charges of the modern oil-engine plant in a remarkable way.

Among those parts which are subject to occasional renewal the most important are pistons, liners and cylinder-heads, but these represent a relatively small fraction of the



Air-compressor parts are protected against breakage and corrosion by nickel alloy

total cost of the engine. On crosshead engines pistons are hardly ever replaced and with the progress of modern design, cylinder-heads too are gradually being brought into the class of those engine parts which may be said to last indefinitely.

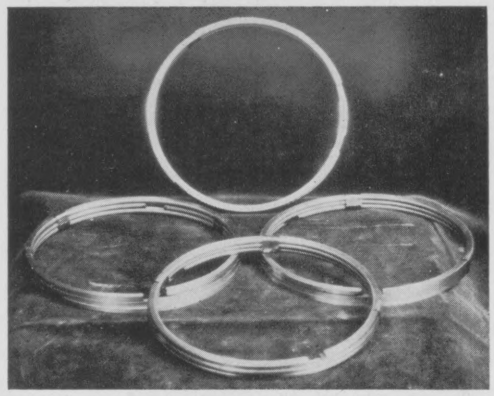
This leaves bearing shells, liners, piston-rings and valves as the parts in which a reduction of upkeep is worth striving for.

By a somewhat unusual coincidence it has been found that the use of nickel in connection with all of these parts is capable of effecting considerable economies in maintenance. Cast iron, as has been found in automobile practice both in the United States and abroad, can be considerably improved by the addition of from two to five per cent of nickel. It has the remarkable property of allowing the metal to be poured freely into the most intricate moulds without at the same time sacrificing toughness and close grain structure. Phosphorus, a very harmful element in cast iron, does make the melt pour freely, but the metal containing it is of so poor a quality that it can be used only for inferior service such as in making window weights and house heating radiators. Although positive results have been achieved with the use of nickel in the treatment of cast iron, reports on the subject are not yet complete and we hope to take the matter up in more detail at an early date.

Exhaust valves for four-cycle engines have been considerably improved by making the valve heads of nickel or nickel-alloy in the form of a monel metal, a practice which is being applied on a large scale in the automotive industry. Both the valves and seats are subjected to the simultaneous action of three injurious agencies, namely, heat, corrosion and mechanical stresses. It would be easy enough to select the material capable of resisting any one of these agencies, but to get something that is proof against all of them at once is not so easy. Monel metal and nickel alloy in general have combined the properties of heat resistance, chemical inertness and strength to a greater extent than any of the engineering materials commonly used.

It is readily apparent, therefore, why the use of nickel or its alloy should have an important bearing on the subject of exhaust valve design. As may be seen from the illustrations, nickel or monel metal lends itself readily for being used on exhaust valves in which it has already become a frequent practice to make a separate ring-like insert around that part of the head which forms the seat. These have, in the past, been made of cast iron rings secured in various ways to steel spindles, but the success which has been recently achieved by the use of monel metal for this purpose shows clearly that a nickel insert would have marked advantages as compared with cast iron. It is ductile, practically break-proof and can resist fire and corrosion even better than close-grained cast iron.

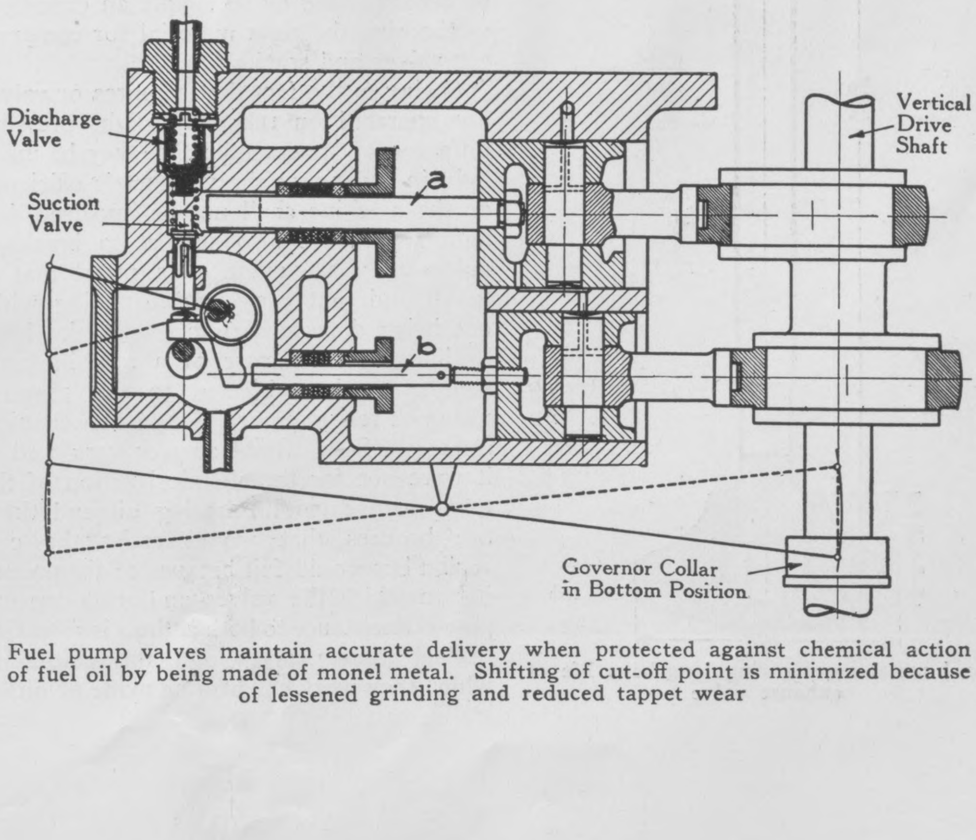
A common practice in designing exhaust valves is to insert a removable seat at the bottom of the cage, an expedient which



Monel metal piston rings for air-compressor

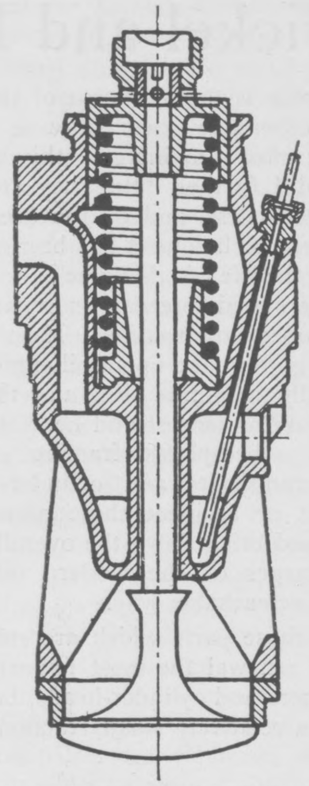
has long been used even when the ring is made of cast iron. In that case the cage itself is made of a soft gray iron, while a hard white iron is chosen for the ring. If something happens to the latter, it is inexpensive to renew and spares can be carried in stock much more cheaply than the entire valve cages could be. However, the cast iron cage-rings succumb to the severe service to which they are put and ultimately cost more than the single nickel or nickel-alloy ring which would give the same length of service.

But it would be short-sighted to compare the relative advantages of nickel and cast irons for these functions on the basis of their own cost alone. A far more vital consideration is thesafeguarding of the engine against shut-downs and delays, and the insurance against such troubles is so valuable that the insignificant

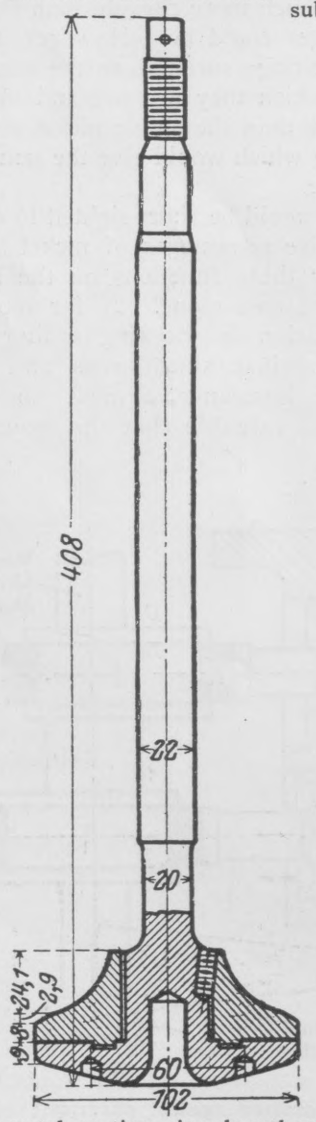


Fuel pump valves maintain accurate delivery when protected against chemical action of fuel oil by being made of monel metal. Shifting of cut-off point is minimized because of lessened grinding and reduced tappet wear

Exhaust valves made entirely of monel metal and used in 1200 b. h. p. United States submarine Diesel engines



Separate interchangeable seating ring at base of exhaust valve cage quickly pays for itself in reduced overhauls and increased regularity of engine operation



Monel metal seating ring lengthens life of exhaust valve

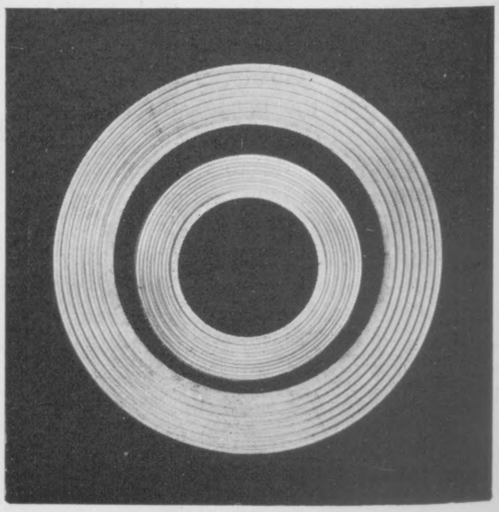
cost of valves and seats cannot be measured against it at all.

For an air-injection Diesel engine nickel-alloys offer decided advantages when used for compressor valves and seats. In the process of compressing air a part of the lubricating oil used in the compressor is decomposed to form acidulous sticky substances which attack valves and seats. Although this difficulty merely serves to increase the maintenance slightly on the entire engine, its elimination is, nevertheless, worth striving for especially when it can be accomplished by so simple an expedient as choosing the right material for compressor valves and seats.

Owing to the fact that compressor valves are operated on relatively slight pressure differences it is essential that they be made light in order that the volumetric efficiency of the machine shall not be impaired, but light waves are also subject to breakage unless they are made of a metal that is tough and that can stand battering without being deformed or crystallized. Here again we have a case of a machine part simultaneously subjected to the requirements of resisting corrosion and mechanical stresses. Steel would answer very well if it were not for the chemical action of the partly consumed lubricating oil and there are bronzes that would resist the corrosion but would fail because of the pounding to which the valves and seats are exposed. Resistance to both actions is essential.

Fuel pump valves and the guides in which they work can also be made of nickel or monel metal with improvements in the service given by an engine that far outweigh the slight extra cost. Fuels containing sulphur and water are apt to be corrosive and pumps with suction valve regulation must have valves that are as free as possible from mechanical wear, if accurate load distribution to the various engine cylinders is to be maintained. Either pitting of the seats or wear on the tails of the suction valves will quickly make itself noticeable in overloading some cylinders while others idle, and in this case it is of great advantage to have valves and seats that are free from both kinds of unbalancing and disturbing influence.

Our illustration shows a monel metal valve which was used on submarine engines built by the United States Navy substantially according to the designs of the M.A.N. Works. Submarine service, it need hardly be added, is about the severest there is and the use of entire valves made of this high grade material affords evidence of the fact

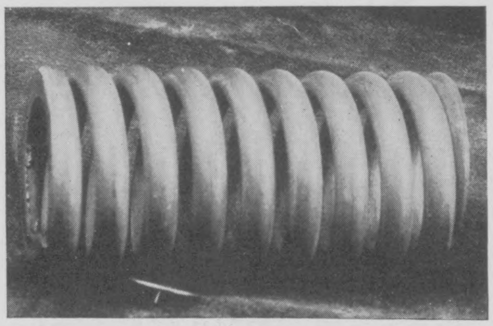


Monel-metal-asbestos gaskets

that it has advantages possessed by few other materials.

Corrugated gaskets made of monel metal are illustrated herewith. Although we do not know of any specific cases in which they have been applied to oil-engines, there can be little doubt they possess desirable qualities for this service. Monel metal can be treated in such a way as to secure any desired degree of hardness and for gaskets we presume that the most ductile variety would be used.

Piston rings, of which we also illustrate samples, have shown three times the life of cast-iron rings when used on traction compressors for the New York Elevated Railway System. Although the hardest monel metal is not as hard as cast iron it has, nevertheless, been freer from wear when used in contact with cast iron than rings of the ordinary type. This may be explained by reference to the fact that combined



Monel metal can be used for compressor relief valve spring because of its resistance to heat

chemical and mechanical action are frequently more destructive than either one of these agencies alone. A homely but forcible example of this principle is furnished every time one washes one's hands. Soap alone will not remove the dirt if the hands are merely dipped in a soap solution. Water alone will not remove it no matter how much one may rub and scour. But if the dirt is loosened by the chemical action of the soap, then it is an easy matter to strip it off in the ordinary washing process. In the case of rubbing cast iron on cast iron such as occurs when cast iron rings are used in ordinary cylinders, wear is accelerated because the corrosive effect of partially decomposed lubricating oil starts loosening the granules of metal, which are then easily removed by the mechanical action of the reciprocating piston.

Monel metal, which is immune against chemical attack, is therefore less subject to wear than the harder cast iron.

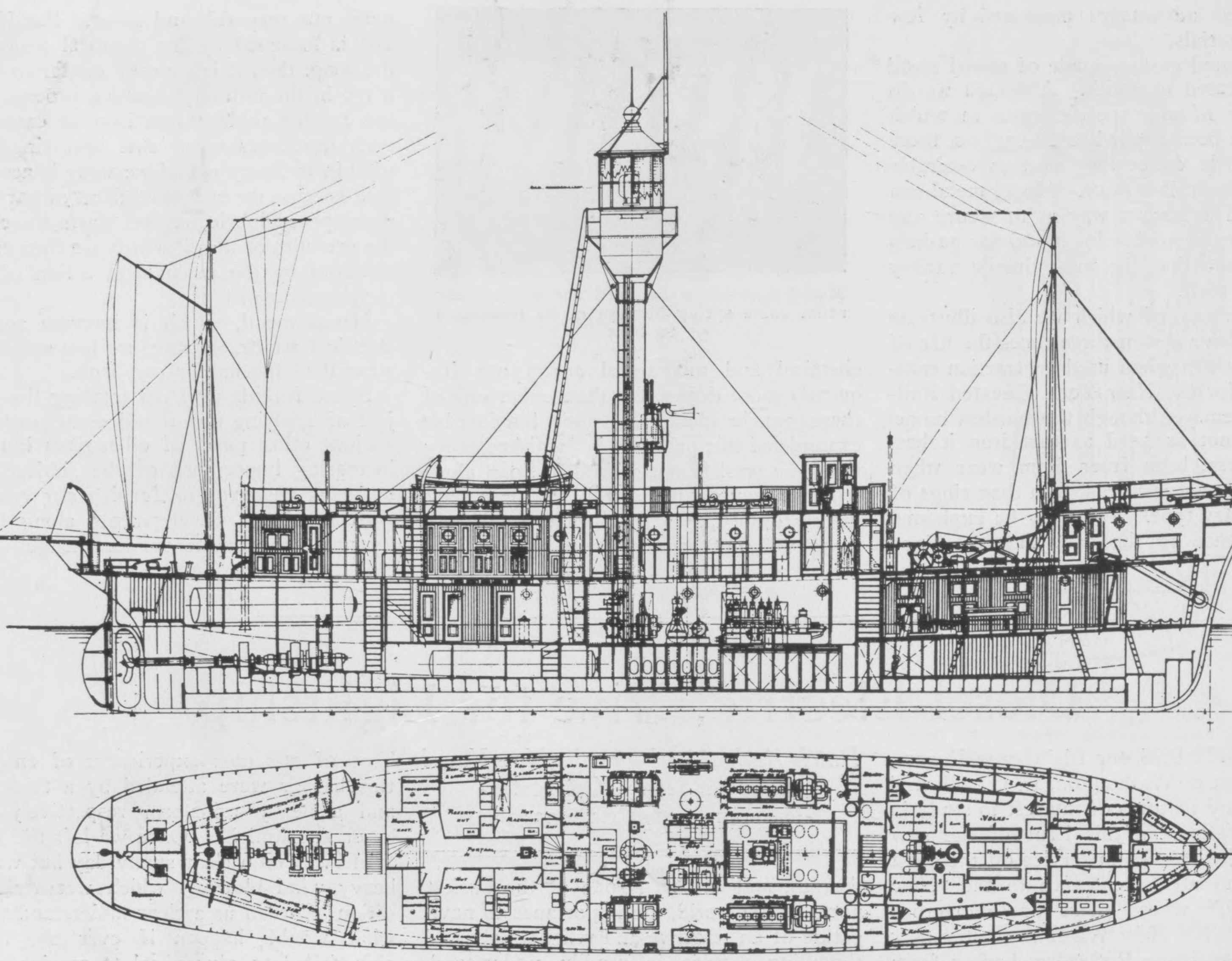
Space forbids us from treating the subject of applying nickel and monel metal to various other parts of oil-engines but the increasing importance of the subject will make us endeavor to furnish our readers with the latest developments along these lines as they come to our knowledge.

Diesel-Electric Drive for Lightship

Dutch Authorities Place the New Vessel MAAS *in Service Off Rotterdam Harbor Entrance*

DOUBTLESS our Lighthouse Department at Washington, D. C., will find many features of interest to study in the illustrations in this issue of the new lightship just placed in service off the coast of Holland at the entrance to the "New Waterway," where there are dangerous sandbars. The New Waterway is the only means of reaching Rotterdam harbor from the sea, and as this is one of the busiest ports of the world, the importance to navigation of an effective and reliable light and signalling service is readily understood. Two of our own experiences of entering this harbor were attended by a thick fog and a heavy rainstorm respectively—the latter at midnight. Once we left the New Waterway on a clear sunny day but with a heavy wind blowing, which weather condition afforded us a clear understanding of what would happen if ever the lightship failed to give absolute service.

On guard off Rotterdam Harbor. Twin oil-engines instantly make power available for signalling or shifting anchorage when weather requires it



"Maas," a Diesel-electric lightship, is the faithful watchdog on guard outside of Rotterdam Harbor. Twin 75 b. h. p. engines supply power for populsion, electric lighting, and compressed-air signalling

For such a vessel Diesel-electric drive seems to be the ideal form of power, as with one set of main oil-engines electric power can be generated and used for lighting, heating and signalling, as well as for propulsion should a storm blow her away from the anchorage. The power is ever ready for instant action without constant work on the part of her crew, and without continually eating away the fuel, except the small quantity necessary for light and heat.

The Maas, as the ship is named, has the following dimensions:

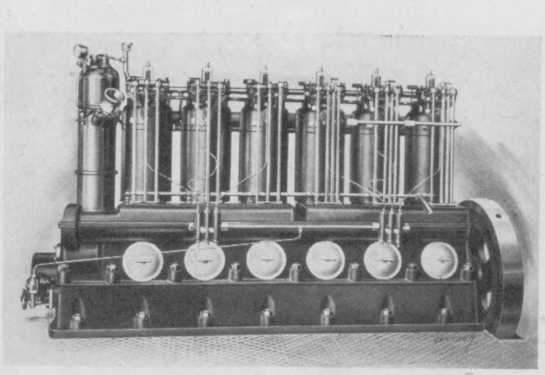
Length	153′ 0″
Breadth	24′ 6″
Draft	7′ 4″
Power	150 b.h.p.

The engine-room is a little forward of amidships, and contains two Atlas-Polar Diesels of 75 b.h.p. each at 550 r.p.m. There also is a 12 b.h.p. Brons oil-engine driving a d.c. generator for lighting the engine-room and which can also provide current for an emergency air-compressor. Each of the main engines is of the four-cycle type, the cylinders having a bore of 165 mm. (6.496″) by 200 mm. (7.87″) stroke. They are direct-coupled to 80-volt generators.

When the craft is at anchor, either Diesel engine can furnish the necessary power. For propelling purposes there are installed in the stern of the ship two 60 b.h.p. electric motors of 80 volts each, or sufficient for a speed of 6½ knots.

All auxiliaries are electrically operated. Two air-compressors for fog signalling—one a standby, are included, each having a 35 b.h.p. electric motor and furnishing air at 35 lbs. pressure. Then there is a 40 b.h.p. motor on the anchor windlass.

A third electric-driven air compressor delivers air at 142 lbs., taking about 12 h.p., and a fourth with 7 h.p. electric motor delivers at about 850 lbs. acting as an emergency compressor for filling up the blast and starting air bottles when required. In the engine-room two bottles containing air of 140 lbs. are installed for giving air immediately when fog signalling is unexpectedly required. This air is reduced to 35 lbs. for the sirens. In the meantime the Diesel engines, motors, and compressors may be started. The engine-room, of course, is equipped with bilge and ballast pumps.



One of the main Diesel engines of the lightship "Maas"

Because of lack of space we were prevented from publishing a picture of remarkable interest showing the interior of the lightship's engine-room. The two main Diesel generators are located on the sides and take up so little room that it is difficult to find them in the picture. A large open hatch admits a flood of light to the engine-room, in which is placed a signal control box with a number of handles running to the signal apparatus on deck. Everything is arranged in such a way as to facilitate prompt action on the part of the crew and the danger of mistakes is minimized. As we have stated at the beginning of the article, the Maas might well be taken as an example by American lighthouse authorities for the construction of a modern vessel to be used in American waters. To judge by the number of instances in which the Lighthouse Department has taken advantage of modern oil-engine power for the propulsion of Lake ships and for the operation of signalling devices at exposed and isolated points, the time is not far distant when some ocean-going lightships will be constructed and placed in commission in the waters surrounding the United States.